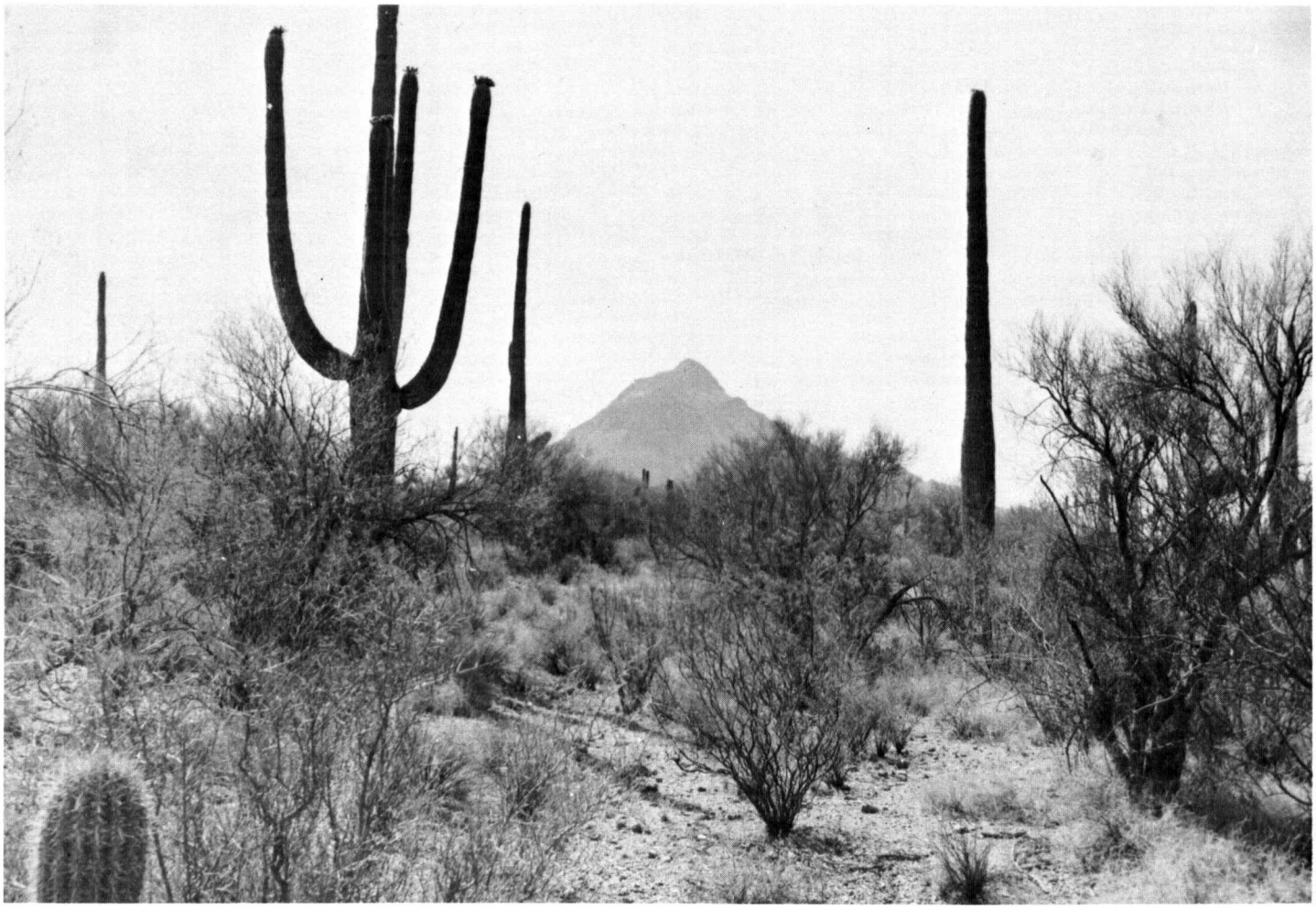
SOIL SURVEY OF
Maricopa County, Arizona
Central Part



United States Department of Agriculture
Soil Conservation Service
in cooperation with
University of Arizona
Agricultural Experiment Station

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in the period 1958–72. Soil names and descriptions were approved in 1972. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1972. This survey was made cooperatively by the Soil Conservation Service and the University of Arizona Agricultural Experiment Station. It is part of the technical assistance furnished to the Agua Fria-New River and Buckeye-Roosevelt Natural Resource Conservation Districts.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms, ranches, and woodlands; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for farming, industry, and recreation.

Locating Soils

All the soils of Maricopa County, Central Part, are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information. This guide lists all the soils of the county in alphabetic order by map symbol and gives the capability classification of each. It also shows the page where each soil is described and the page for the capability unit, range site, and wildlife habitat group in which the soil has been placed.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the descriptions of the capability units.

Homeowners and landscape architects can learn which plants are suitable for individual soils in the section "Trees and Shrubs."

Game managers, sportsmen, and others can find information about soils and wildlife in the section "Managing Soils for Wildlife."

Ranchers and others can find, under "Range Resources," groupings of the soils according to their suitability for range, and also the names of many of the plants that grow on each range site.

Community planners and others can read about soil properties that affect the choice of sites for dwellings, industrial buildings and for recreation areas in the section "Engineering Uses of the Soils."

Engineers and builders can find, under "Engineering Uses of the Soils," tables that contain estimates of soil properties and information about soil features that affect engineering practices.

Scientists and others can read about how the soils formed and how they are classified in the section "Formation and Classification of Soils."

Newcomers in Maricopa County, Central Part, may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the information about the county given at the beginning of the publication and in the section "Additional Facts About the Area."

Cover picture: **Desert plant cover on Pinamt soil, chiefly Saguaro carte, mesquite, palo verde, creosote, bursage, and scattered annual grasses. Gachado soil and Rock outcrop on mountain in background.**

Contents

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SOIL SURVEY OF MARICOPA COUNTY, ARIZONA, CENTRAL PART

BY GEORGE W. HARTMAN, SOIL CONSERVATION SERVICE, UNITED STATES DEPARTMENT OF AGRICULTURE

FIELDWORK BY GEORGE W. HARTMAN, RUDOLPH G. SCHURIG, RUSSELL E. BARMORE, NORMAN N. DAVIS, JAMES M. POWELL, BRUCE A. WHITNEY, GORDON K. TANAKA, AND LEROY A. deMOULIN, SOIL CONSERVATION SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH THE UNIVERSITY OF ARIZONA AGRICULTURAL EXPERIMENT STATION

THE AREA SURVEYED (fig. 1), 1,076,330 acres or about 1,682 square miles, is in the central and west-central part of Maricopa County. It extends from 16th Street in Phoenix to the Yuma County line. Of this area, approximately 321,000 acres is under cultivation, 73,000 acres is urban, and the rest is desert. Large parts of the desert are State or federally owned. Phoenix, the largest city in Arizona and the State capital, is the county seat of Maricopa County. The population in 1970 was 582,500.[1] Other cities and towns are Avondale, Buckeye, Cashion, El Mirage, Glendale, Goodyear, Litchfield Park, Peoria, Sun City, Surprise, Tolleson, and Youngtown. Within the survey area is the Agua Fria-New River and the Buckeye-Roosevelt Natural Resource Conservation Districts.

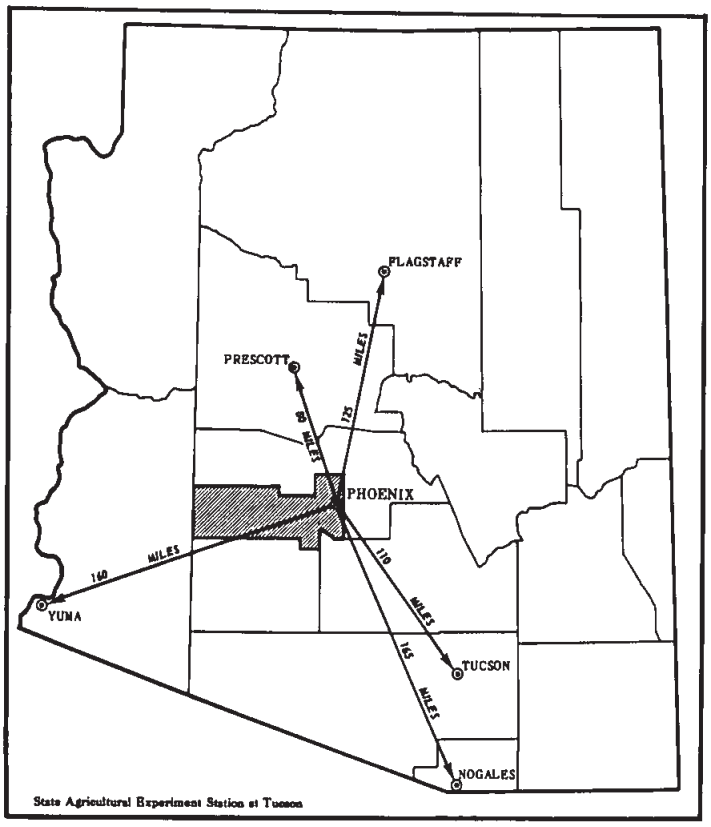

Figure 1.—Location of Maricopa County, Arizona, Central Part.

[1] U.S. Dept. of Commerce, Bureau of the Census.

The area is characterized by a highly developed and intensive agriculture. Cotton and alfalfa are the principal crops. Barley, wheat, grain sorghum, safflower, citrus, grapes, and truck crops are also important. The truck crops are lettuce, cabbage, broccoli, carrots, radishes, potatoes, onions, tomatoes, canteloup, and watermelon. Because the growing season is long, double cropping is commonly practiced and the land is seldom idle. Dairying and sheep and cattle feeding are important enterprises. Much of the productive acreage in the vicinity of Phoenix is being developed rapidly as home or industrial sites.

Winters are mild in the survey area, but summers are hot and dry. The two periods of rainfall are the last half of summer and late in fall and in winter.

Irrigation is needed for crops. The sources range considerably in quality and quantity. Surface water is supplied from reservoirs on the Agua Fria, Salt, and Verde Rivers. The principal organized irrigation districts are the Maricopa, Buckeye-Roosevelt, Salt River, St. Johns, New States, and Arlington. Underground water supplements surface water and in some areas is the sole supply. The Harquahala and Rainbow Valleys and the areas near Tonopah and Wintersburg depend upon underground water, but the water table is continually dropping.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in Maricopa County, Central Part, where they are located, and how they can be used. The soil scientists went into the county knowing they likely would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes, the size and speed of streams, the kinds of native plants or crops, the kinds of rock and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Laveen and Avondale, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface layer and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Laveen loam, 1 to 3 percent slopes, is one of several phases within the Laveen series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map at the back of this publication was prepared from aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soils of some other kind that have been seen within an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series, or of different phases within one series. Three such kinds of mapping units are shown on the soil map of Maricopa County, Central Part: soil complexes, soil associations, and undifferentiated groups.

A soil complex consists of areas of two or more soils, so intermingled or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. .Generally, the name of a soil complex consists of the names of the dominant soils, joined by a hyphen. Rillito-Perryville complex, 5 to 20 percent slopes, is an example.

A soil association is made up of adjacent soils that occur as areas large enough to be shown individually on the soil map but are shown as one unit because the time and effort of delineating them separately cannot be justified. There is a considerable degree of uniformity in pattern and relative extent of the dominant soils, but the soils may differ greatly one from another. The name of an association consists of the names of the dominant soils, joined by a hyphen. Antho-Valencia association is an example.

An undifferentiated group is made up of two or more soils that could be delineated individually but are shown as one unit because, for the purpose of the soil survey, there is little value in separating them. The pattern and proportion of soils are not uniform. An area shown on the map may be made up of only one of the dominant soils, or of two or more. If there are two or more dominant series represented in the group, the name of the group ordinarily consists of the names of the dominant soils, joined by "and." Carrizo and Brios soils is an example.

In most areas surveyed there are places where the soil material is so rocky, so shallow, so severely eroded, or so variable that it has not been classified by soil series. These places are shown on the soil map and are described in the survey, but they are called miscellaneous land types and are given descriptive names. Dune land is an example.

While a soil survey is in progress, soil scientists take soil samples needed for laboratory measurements and for engineering tests. Laboratory data from the same kinds of soil in other places are also assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soil. Yields under defined management are estimated for all the soils.

Soil scientists observe how soils behave when used as a growing medium for native and cultivated plants, and as material for structures, foundations for structures, or covering for structures. They relate this behavior to properties of the soils. For example, they observe that filter fields for onsite disposal of sewage fail on a given kind of soil, and they relate this to the slow permeability of the soil or its high water table. They see that streets, road pavements, and foundations for houses are cracked on a named kind of soil and they relate this failure to the high shrink-swell potential of the soil material. Thus, they use observation and knowledge of soil properties, together with available research data, to predict limitations or suitability of soils for present and potential uses.

After data have been collected and tested for the key, or benchmark, soils in a survey area, the soil scientists set up trial groups of soils. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others. They then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under current methods of use and management.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in Maricopa County, Central Part. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in an area, who want to compare different parts of an area, or who want to know the location of large tracts that are suitable for a certain kind of use. Such a map is a useful general guide in managing a watershed, a wooded tract, or a wildlife area, or in planning engineering works, recreational facilities, and community developments. It is not a suitable map for planning the management of a farm or field, or for selecting

the exact location of a road, building, or similar structure, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The soil associations in this survey area have been grouped into three general kinds of landscapes for broad interpretative purposes. Each of the broad groups and the 10 soil associations are described on the pages that follow. The texture mentioned in the legend for each association refers to the dominant texture of the surface layer of the major soils.

Soils Formed in Recent Alluvium

This group of associations consists of nearly level to gently sloping soils formed in recent alluvium on alluvial fans at the base of mountains, in stream channels, on low stream terraces, and on valley plains.

1. Gilmani-Estrella-Avondale association

Nearly level loams and clay loams on valley plains and low stream terraces

This association (fig. 2) is on the broad, flat valley plains and low stream terraces that occur throughout the survey area. The soils formed in recent alluvium that was derived from a wide variety of rock, including granite-gneiss, schist, andesite, rhyolite, basalt, and quartzite. The natural vegetation is creosotebush, cactus, annual weeds and grasses, and scattered mesquite and paloverde trees. The elevation ranges from 750 to 1,400 feet. The mean annual precipitation is 6 to 8 inches, the mean annual air temperature is 69° to 74° F, and the frost-free season is 250 to 300 days.

This association makes up about 25 percent of the survey area. It is about 55 percent Gilman soils, 10 percent Estrella soils, 10 percent Avondale soils, and 25 percent Glenbar, Antho, Avonda, Agualt, Gadsden, and Cashion soils.

Gilman soils are fairly close to major stream channels. Estrella soils are along the margin of most mapped areas in slightly higher positions than Gilman soils. Avondale soils are in positions intermediate between Gilman and Estrella soils, mainly in the Buckeye and Salt River Valleys.

Gilman soils are 60 inches or more of loam or very fine sandy loam that is thinly stratified with finer or coarser textured material in the lower part. Estrella soils are

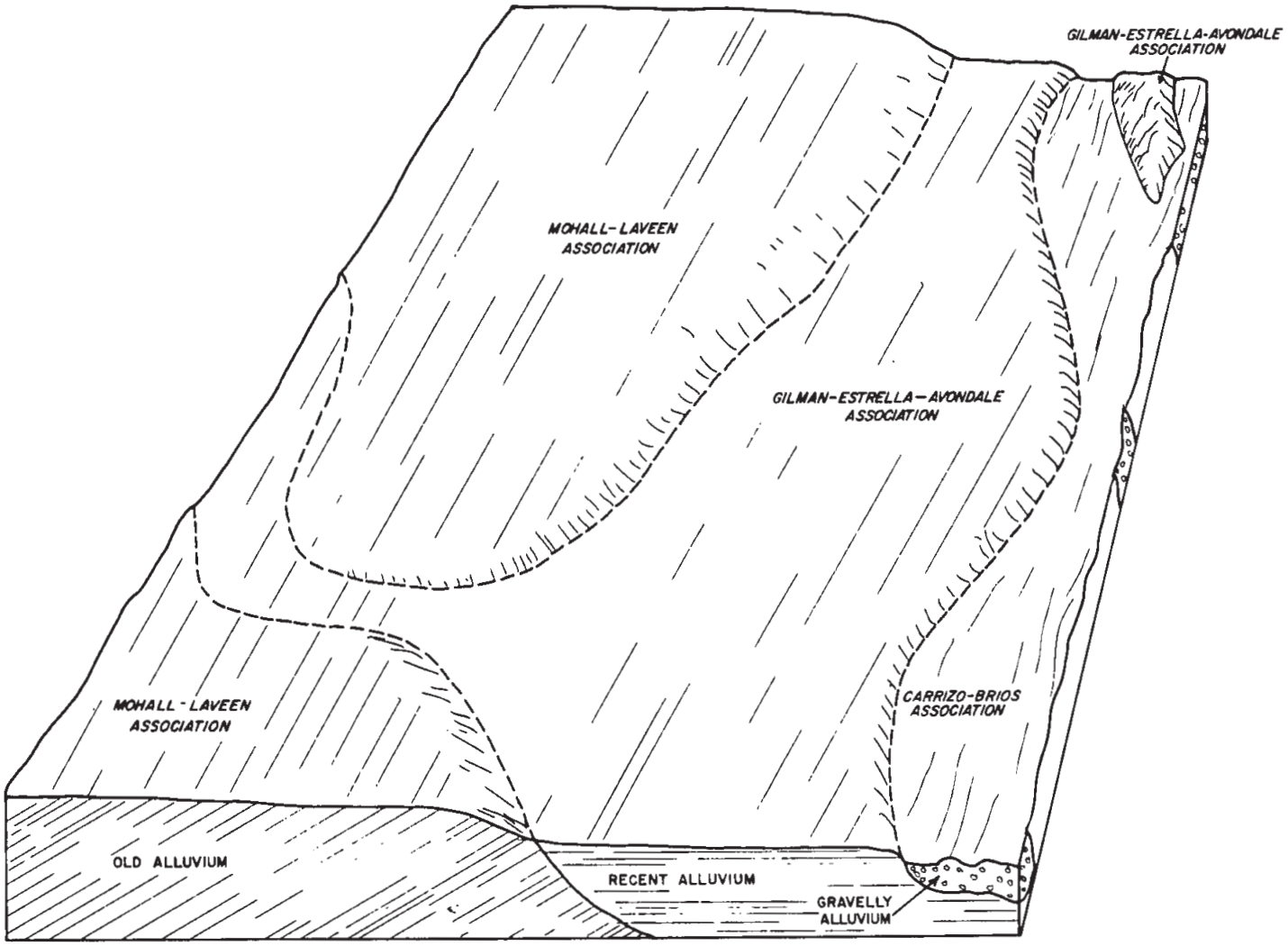

Figure 2.—**Representative pattern of soils in the Gilman-Estrella-Avondale, the Carrizo-Brios, and the Mohall-Laveen associations.**

loams or very fine sandy loams 20 to 39 inches deep over an old buried clay loam soil. Avondale soils have a dark-colored clay loam surface layer over loam or very fine sandy loam that is thinly stratified with finer or coarser textured material.

Parts of the cities of Phoenix, Glendale, and Buckeye are on this association. Cotton, alfalfa, small grain, safflower, sugar beets, grapes, citrus, and vegetables are the chief crops. A few areas are used as range following seasonal rains.

2. *Antho-Valencia association*

Nearly level sandy loams on recent alluvial fans and valley plains

This association (fig. 3) is on young alluvial fans and valley plains that are 1 mile to 5 miles from the mountains. In places it is underlain by an older land surface (see also fig. 4, p. 5). It occurs throughout the survey area. The soils formed in young alluvium that was derived from a wide variety of rock but was dominantly granitic. The native vegetation is creosotebush, cactus, annual weeds and grasses, and scattered mesquite and paloverde trees. The elevation ranges from 800 to 1,400 feet. The mean annual precipitation is 6 to 8 inches, the mean annual air temperature is about 69° to 74° F, and the frost-free season is 250 to 300 days.

This association makes up about 14 percent of the survey area. It is about 60 percent Antho soils, 15 percent Valencia soils, and 25 percent Gilman, Coolidge, Agualt, Maripo, Vint, Estrella, Carrizo, and Tremant soils.

Antho soils are sandy loam 40 inches deep or more. They are in the center of most mapped areas, and Valencia soils are along the margins. Valencia soils are sandy loam or fine sandy loam 20 to 39 inches deep over an old buried clay loam soil.

This association is cultivated in areas where irrigation water is available. Cotton, alfalfa, small grain, safflower, sugar beets, grapes, and citrus are the chief crops. A few areas are used as range. Part of the city of Phoenix is on this association.

3. *Carrizo-Brios association*

Nearly level to gently sloping gravelly sandy loams and sandy loams in stream channels and on low stream terraces

This association (see fig. 2, p. 3) is in or adjacent to the channels of the New River and the Gila, Salt, Agua Fria, and Hassayampa Rivers and on a few of the adjacent low-lying stream terraces. The soils formed in recent alluvium that was derived from a wide mixture of acid and basic igneous and metamorphic rock. They are subject to occasional flooding. The native vegetation is saltcedar, arrowweed, creosotebush, and saltbush. The elevation ranges from 750 to 1,300 feet. The mean annual air temperature is 69° to 74° F, and the frost-free season is 250 to 300 days.

This association makes up about 5 percent of the survey area. It is about 30 percent Carrizo soils, 30 percent Brios soils, 15 percent Vint soils, and 25 percent Torripsamments and Torrifluvents, frequently flooded, and Cashion, Gadsden, Maripo, and Antho soils.

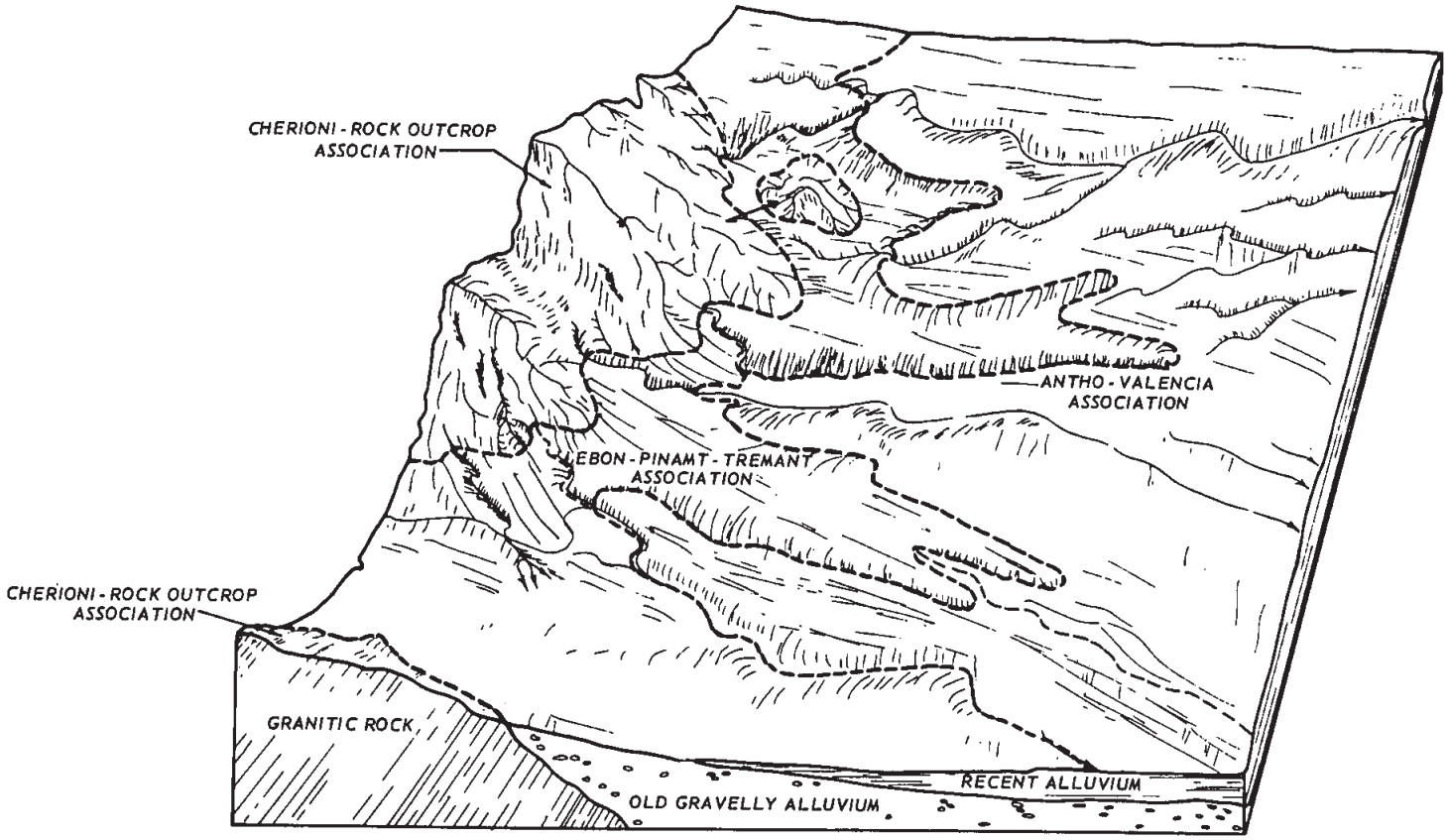

Figure 3.—Representative pattern of soils in the Antho-Valencia, the Ebon-Pinamt-Tremant, and the Cherioni-Rock outcrop associations.

Carrizo soils are typically in the lowest positions, nearest the present stream channels. Vint soils are in higher positions, along the outer margins of the mapped areas. Brios soils are in positions intermediate between Carrizo and Vint soils.

Carrizo soils have a surface layer of yellowish-brown gravelly sandy loam about 5 inches thick over pale-brown very gravelly coarse sand that extends to a depth of 60 inches or more. Brios soils have a surface layer of brown sandy loam about 14 inches thick over brown sand that extends to a depth of 60 inches or more. Vint soils are pale-brown loamy fine sand about 60 inches deep.

This association is cultivated in only a few areas, which are not subject to flooding. A few areas are used as range. The part of the assocation near Buckeye and Arlington has been designated the Fred J. Weiler Green Belt and serves as an important nesting area for dove and quail.

4. Torrifluvents association

Nearly level to gently sloping soils that are gravelly, cobbly, and stony throughout; on recent alluvial fans at the base of mountains

This association is on alluvial fans at the base of the Estrella Mountains in Rainbow Valley. It is dissected by shallow stream channels that have cut 1 foot to 15 feet below the surface. The soils formed in cobbly, gravelly, and stony alluvium that was derived from the granite-gneiss mountains above. The native vegetation is creosotebush, cactus, bursage, and scattered mesquite, paloverde, and ironwood trees. The elevation ranges from 1,250 to 1,500 feet. The mean annual precipitation is 6 to 8 inches, the mean annual air temperature is 69° to 74° F, and the frost-free season is 260 to 300 days.

This association makes up about 1 percent of the survey area. It is about 85 percent Torrifluvents and 15 percent Gunsight, Pinamt, and Pinal soils.

Torrifluvents are stratified and are 35 to 80 percent cobbles, gravel, and stones. The stony soils are more prevalent in the steeper areas nearest the base of mountains. The gravelly soils are more prevalent in areas more distant from the mountains.

This association is not cultivated. A few areas are used as range following seasonal rain.

Soils Formed in Old Alluvium

This group of associations consists of nearly level to moderately steep soils in old alluvium on alluvial fans and valley plains.

5. Rillito-Gunsight-Perryville association

Nearly level to moderately steep gravelly loams and loams on old alluvial fans and valley plains

This association (fig. 4) is on old alluvial fans and valley plains, mainly in the western part of the survey area. Some areas are near the base of mountains, but others are as much as 10 miles away. The undulating landscape is dissected by many stream channels that have cut 1 foot to 20 feet below the surface. The soils formed in old gravelly alluvium that was derived mainly from granite-gneiss, schist, andesite, and limestone. The natural vegetation is mainly creosotebush and scattered mesquite and paloverde trees. The elevation ranges from 800 to 1,400

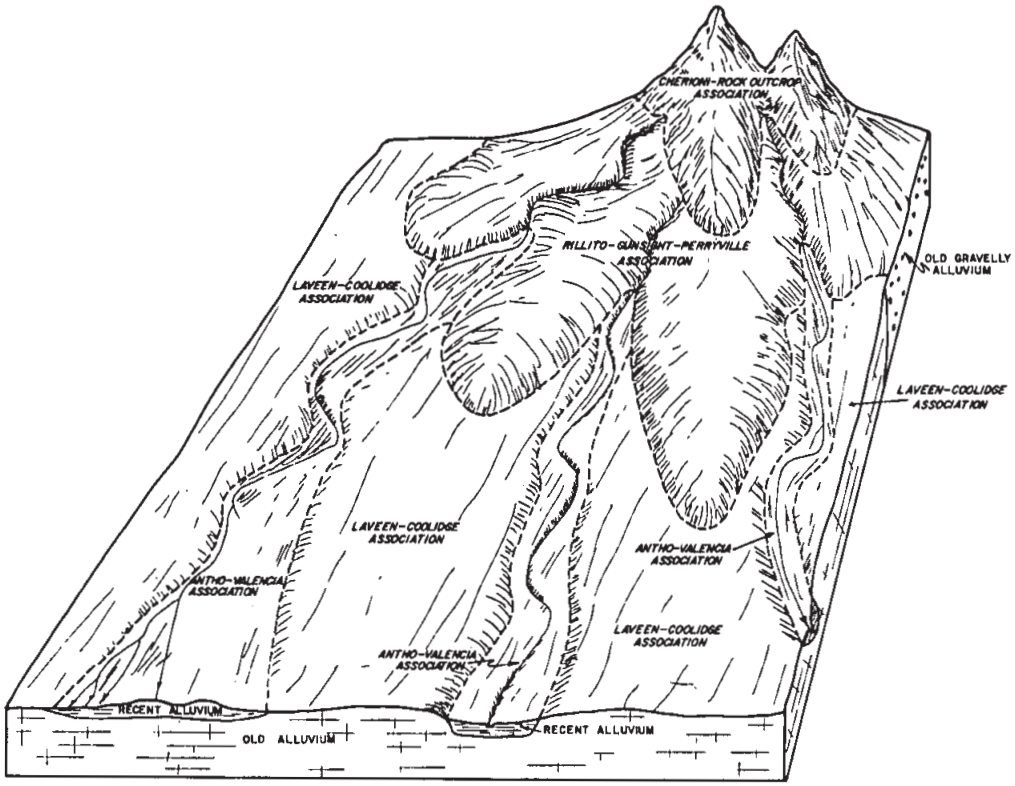

Figure 4.—**Representative pattern of soils in the Rillito-Gunsight-Perryville, the Laveen-Coolidge, the Antho-Valencia, and the Cherioni-Rock outcrop associations.**

feet. The mean annual precipitation is 6 to 8 inches, the mean annual air temperature is 67° to 74° F, and the frost-free season is 250 to 300 days.

This association makes up about 16 percent of the survey area. It is about 25 percent Rillito soils, about 20 percent Gunsight soils, about 10 percent Perryville soils, and 45 percent Pinal, Laveen, Harqua, and Cherioni soils. One area south of Saddle Mountain is almost entirely Pinal soils.

Rillito soils are on the more gently sloping edges of alluvial fans and valley plains. Gunsight soils are in the slightly higher positions in the center of alluvial fans. Perryville soils are in slightly lower positions along the outer margins of the alluvial fans and valley plains.

Rillito soils have a surface layer of light yellowish-brown loam about 10 inches thick. The underlying material to a depth of 19 inches is light-brown gravelly loam and pinkish-white to very pale brown gravelly loam or gravelly sandy loam to a depth of 60 inches. The underlying material contains soft masses, filaments, and concretions of lime.

Gunsight soils have a surface layer of light-brown and pale-brown gravelly loam about 3 inches thick. The underlying material to a depth of 60 inches is light-brown very gravelly loam. The underlying material contains soft masses and concretions of lime and in some profiles is cemented with lime.

Perryville soils have a surface layer of very pale brown gravelly loam about 9 inches thick. The underlying material is very pale brown gravelly loam or very gravelly sandy loam. The profile is extremely calcareous.

Only a small part of this association is cultivated. Cotton, alfalfa, small grain, safflower, citrus, and sugar beets are the chief crops. A few areas are used as range. A few homes are built on these soils near Lookout Mountain in the city of Phoenix.

6. *Mohall-Laveen association*

Nearly level loams and clay loams on old alluvial fans and valley plains

This association (see fig. 2, p. 3) is on alluvial fans and valley plains. The largest area is in the Salt River Valley. A few smaller areas are in the Harquahala Valley. The soils formed in old alluvium that was derived from granite-gneiss, rhyolite, schist, and some acid and basic igneous rock and limestone. The native vegetation is creosotebush and scattered mesquite and paloverde trees. The elevation ranges from 950 to 1,400 feet. The mean annual precipitation is 6 to 8 inches, the mean annual air temperature is 68° to 74° F, and the frost-free season is 250 to 300 days.

This association makes up about 12 percent of the survey area. It is about 45 percent Mohall soils, 40 percent Laveen soils, and 15 percent Tremant, Estrella, Vecont, Coolidge, and Valencia soils.

The soils are in similar positions on the landscape, but Mohall soils are in slightly lower positions on concave surfaces and Laveen soils are on slightly convex surfaces. The difference in elevation between the soils generally is less than 2 feet.

Mohall soils have a clay loam subsoil that extends to a depth of about 35 inches. The underlying material is loam or very fine sandy loam. The underlying material and lower part of the subsoil contain soft masses of lime. Laveen soils are loams that have soft masses and concretions of lime at a depth of about 24 inches.

Parts of the cities of Phoenix, Peoria, Surprise, Cashion, and Litchfield Park are on this association. The association is irrigated. Cotton, alfalfa, small grain, sugar beets, safflower, and citrus are the main crops. A few areas are used as range.

7. *Laveen-Coolidge association*

Nearly level sandy loams, loams, and clay loams on old alluvial fans and valley plains

This association (see fig. 4, p. 5) is on alluvial fans and valley plains that are 2 to 5 miles from the mountains. The largest area is a 3- to 5-mile wide area extending from Avondale to the Hassayampa River. A few smaller areas are in the Rainbow and Harquahala Valleys. The soils formed in alluvium that was derived from granite-gneiss, schist, limestone, andesite, rhyolite, and basalt. The native vegetation is creosotebush and scattered mesquite and paloverde trees. The elevation ranges from 800 to 1,400 feet. The mean annual precipitation is 6 to 8 inches, the mean annual air temperature is 69° to 73° F, and the frost-free season is 250 to 300 days.

This association makes up about 9 percent of the survey area. It is about 60 percent Laveen soils, 20 percent Coolidge soils, and 20 percent Mohall, Perryville, Tremant, Antho, Maripo, Rillito, and Gilman soils.

Laveen soils are at the lower ends of alluvial fans and on valley plains. Coolidge soils are in or near stream channels and at the upper ends of alluvial fans nearest the mountains.

Laveen soils are loams that have soft masses and concretions of lime below a depth of about 24 inches. Coolidge soils are sandy loams that have soft masses and a few concretions of lime below a depth of about 24 inches.

Parts of the towns of Buckeye and Avondale are on this association. Cotton, alfalfa, small grains, safflower, sugar beets, and grapes are the main crops. A few areas are used as range.

8. *Ebon-Pinamt-Tremant association*

Nearly level to gently sloping gravelly loams, very cobbly loams, and gravelly clay loams on old alluvial fans at the base of mountains

This association (see fig. 3, p. 4) is on old alluvial fans at the base of the White Tank and Estrella Mountains. It is dissected by numerous stream channels that are entrenched 2 to 25 feet below the surface. The soils formed in old gravelly alluvium that was derived from a wide mixture of granite, granite-gneiss, schist, rhyolite, andesite, and quartzite. The natural vegetation is creosotebush, bursage, cactus, and scattered mesquite and paloverde trees. The elevation ranges from 800 to 1,800 feet. The mean annual precipitation is 6 to 8 inches, the mean annual air temperature is 69° to 74° F, and the frost-free season is 260 to 320 days.

This association makes up about 3 percent of the survey area. It is about 30 percent Ebon soils, 20 percent Pinamt soils, 15 percent Tremant soils, and 35 percent Carrizo, Gunsight, Rillito, Cherioni, and Antho soils.

Ebon soils are at the upper ends of alluvial fans nearest the mountains, Pinamt soils are about halfway down the alluvial fans, and Tremant soils are at the lower ends.

Ebon soils have a cobbly clay subsoil. Pinamt soils have a subsoil of very gravelly sandy clay loam. The underlying material is very gravelly sandy loam. The underlying material and lower part of the subsoil contain accumulations of lime. Tremant soils have a gravelly clay loam and clay loam subsoil. The underlying material is gravelly loam.

Parts of South Mountain Park, White Tank Regional Park, and Estrella Mountain Regional Park are on this association. The association is not cultivated. A few areas are used as range.

9. Casa Grande-Harqua association

Nearly level to sloping, saline-alkali loams, sandy loams, and gravelly clay loams on valley plains

This association is on old valley plains, mainly in the area of Tonapah and Wintersburg. A few areas also are in the Harquahala and Rainbow Valleys. The soils formed in old alluvium that was derived from granite, schist, gneiss, rhyolite tuff, and limestone. The vegetation is saltbush, creosotebush, cactus, and scattered mesquite and paloverde trees. The elevation ranges from 800 to 1,350 feet. The mean annual precipitation is 6 to 8 inches, the mean annual air temperature is 67° to 74° F, and the frost-free season is 250 to 300 days.

This association makes up about 4 percent of the survey area. It is about 30 percent Casa Grande soils, 30 percent Harqua soils, and 40 percent Laveen, Gunsight, Rillito, and Antho soils.

Casa Grande soils are on valley plains parallel to the main drainage systems of the area. Harqua soils are on old alluvial fans that merge with the main drainage system.

Casa Grande soils have a very strongly alkaline clay loam subsoil. The underlying material is very strongly alkaline loam. The subsoil and underlying material contain filaments and soft masses of lime. Harqua soils have a gravelly clay subsoil and underlying material. They are very strongly alkaline and saline. They have a distinct layer of calcium carbonate at a depth of about 12 inches.

This association is irrigated. Cotton, alfalfa, sugar beets, and safflower are the main crops. Some areas are used as range.

Soils of Mountains and Buttes

This association consists of Rock outcrop and areas of shallow soils in steep mountainous areas.

10. Cherioni-Rock outcrop association

Gently sloping to very steep very gravelly loams and Rock outcrop on mountains, buttes, and low hills

This association (see figs. 3 and 4, pp. 4 and 5) is in steep mountainous areas and in less sloping areas at their base. Slopes are complex. The largest areas are in Eagletail Park and the Saddle, Estrella, and Salt River Mountains. The soils formed over granite-gneiss, schist, andesite, basalt, and tuff bedrock. Minor amounts of silt are deposited on these soils by the wind. The vegetation consists of creosotebush, bursage, cactus, and scattered mesquite and paloverde trees. The elevation ranges from 800 to 4,500 feet. The mean annual precipitation is 6 to 8 inches, the mean annual air temperature is 67° to 74° F, and the frost-free season is 250 to 300 days.

This association makes up about 11 percent of the survey area. It is 40 percent Cherioni soils, 35 percent Rock outcrop, and 25 percent Gunsight, Pinal, Gachado, and several shallow soils.

Cherioni soils are on the lower slopes of mountains and on a few pediments and low hills. Rock outcrop is scattered throughout most mapped areas of this association but is more prevalent in the highest parts of mountains and on low hills. Cherioni soils are very gravelly loams about 11 inches thick. They have an indurated hardpan about 7 inches thick over bedrock.

Part of the city of Phoenix is on this association, as well as parts of South Mountain Park, White Tank Regional Park, Estrella Mountain Regional Park, and Buckeye Hills Regional Park. Several television and radio transmitters and water tanks are in the higher lying areas, and parts of two heavy equipment proving grounds are also in these areas. This association is not cultivated. A few areas are used for range.

Descriptions of the Soils

This section describes the soil series and mapping units in Maricopa County, Central Part. Each soil series is described in detail, and then, briefly, each mapping unit in that series. Unless it is specifically mentioned otherwise, it can be assumed that what is stated about the soil series holds true for the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

An important part of the description of each soil series is the soil profile, that is, the sequence of layers from the surface downward to rock or other underlying material. Each series contains two descriptions of this profile. The first is brief and in terms familiar to the layman. The second is much more detailed and is for those who need to make thorough and precise studies of soils. Color terms are for dry soil unless otherwise stated. The profile described in the series is representative of the mapping units in that series. If the profile of a given mapping unit differs from the one described for the series, these differences are stated in describing the mapping unit, or they are differences that are apparent in the name of the mapping unit.

As mentioned in the section "How This Survey Was Made," not all mapping units are members of a soil series. Dune land, for example, does not belong to a soil series but nevertheless, is listed in alphabetic order along with the soil series.

Following the name of each mapping unit is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit is the capability unit, range site, horticultural group, and wildlife habitat group to which the mapping unit has been assigned. The page for the description of each capability unit, range site, and wildlife habitat group can be found by referring to the "Guide to Mapping Units" at the back of this survey.

The acreage and proportionate extent of each mapping unit are shown in table 1. Many of the terms used in

TABLE 1.—*Approximate acreage and proportionate extent of the soils*

Soil	Acres	Percent [1]
Agualt loam	8,059	0.75
Antho sandy loam, 0 to 1 percent slopes	32,548	3.02
Antho sandy loam, 1 to 3 percent slopes	649	.06
Antho sandy loam, saline-alkali	3,654	.34
Antho gravelly sandy loam, 0 to 1 percent slopes	6,014	.56
Antho gravelly sandy loam, 1 to 3 percent slopes	3,619	.34
Antho-Brios sandy loams	9,434	.88
Antho-Carrizo complex, 0 to 1 percent slopes	3,861	.36
Antho-Carrizo complex, 1 to 3 percent slopes	1,106	.10
Antho-Carrizo complex, 0 to 3 percent slopes	29,356	2.73
Antho-Tremant complex, 1 to 5 percent slopes	3,403	.32
Antho-Tremant-Mohall complex, 1 to 5 percent slopes	3,092	.29
Antho association	30,848	2.87
Antho-Valencia association	15,724	1.46
Avonda clay loam	1,842	.17
Avondale clay loam	22,045	2.05
Avondale clay loam, saline-alkali	1,319	.12
Beardsley loam	955	.09
Brios loamy sand	3,969	.37
Brios sandy loam	4,927	.46
Brios loam	1,052	.10
Calciorthids and Torriorthents, eroded	1,394	.13
Carrizo gravelly sandy loam	4,703	.44
Carrizo-Ebon complex, 3 to 12 percent slopes	1,928	.18
Carrizo and Brios soils	17,457	1.62
Casa Grande sandy loam	3,672	.34
Casa Grande loam	6,727	.62
Casa Grande complex	2,170	.20
Casa Grande-Laveen complex, alkali	3,067	.28
Cashion clay, saline-alkali	2,896	.27
Cherioni-Rock outcrop complex	38,260	3.55
Coolidge sandy loam	14,023	1.30
Coolidge gravelly sandy loam, 1 to 3 percent slopes	1,049	.10
Coolidge-Tremant complex	666	.06
Coolidge-Laveen association	16,557	1.54
Dune land	565	.05
Ebon gravelly loam, 0 to 8 percent slopes	3,361	.31
Ebon-Pinamt complex, 0 to 10 percent slopes	7,572	.70
Estrella loam	23,152	2.15
Estrella loam, saline-alkali	2,464	.23
Gachado-Rock outcrop complex	5,467	.51
Gadsden clay loam	689	.06
Gadsden clay	1,063	.10
Gadsden clay, saline-alkali	418	.04
Gilman fine sandy loam	19,693	1.83
Gilman fine sandy loam, saline-alkali	1,153	.11
Gilman loam, 0 to 1 percent slopes	101,777	9.47
Gilman loam, 1 to 3 percent slopes	431	.04
Gilman loam, saline-alkali	16,632	1.55
Gilman complex, saline-alkali	1,464	.14
Gilman-Antho association	19,208	1.78
Gilman-Laveen association	7,486	.70
Gilman, Antho and Glenbar soils, severely eroded	315	.03
Gilman loam, clayey subsoil variant, moderately saline	462	.04
Glenbar loam	2,361	.22
Glenbar loam, saline-alkali	7,630	.71
Glenbar clay loam	21,805	2.03
Glenbar clay loam, saline-alkali	448	.04
Glenbar clay	1,175	.11
Gunsight-Pinal complex, 1 to 10 percent slopes	16,907	1.57
Gunsight-Rillito complex, 0 to 1 percent slopes	6,516	0.61
Gunsight-Rillito complex, 1 to 3 percent slopes	4,455	.41
Gunsight-Rillito complex, 0 to 10 percent slopes	25,630	2.38
Harqua complex, 0 to 3 percent slopes	9,011	.84
Harqua complex, 3 to 8 percent slopes	1,230	.11
Harqua-Gunsight complex, 0 to 5 percent slopes	22,986	2.14
Harqua-Laveen complex	3,706	.34
Harqua-Rillito complex, 1 to 3 percent slopes	4,729	.44
La Palma very fine sandy loam	1,007	.09
Laveen sandy loam	18,355	1.70
Laveen loam, 0 to 1 percent slopes	75,909	7.06
Laveen loam, 1 to 3 percent slopes	1,213	.11
Laveen loam, saline-alkali	6,256	.58
Laveen clay loam	8,049	.75
Laveen-Antho complex, saline-alkali	982	.09
Maripo sandy loam	11,165	1.04
Mohall sandy loam	2,875	.27
Mohall loam	18,973	1.76
Mohall clay loam	31,990	2.97
Mohall clay	1,459	.14
Mohall-Tremant complex, 0 to 3 percent slopes	8,885	.83
Mohall-Laveen association	1,212	.11
Perryville sandy loam	2,084	.19
Perryville loam, saline-alkali	1,712	.16
Perryville gravelly loam, 0 to 1 percent slopes	7,267	.68
Perryville gravelly loam, 1 to 3 percent slopes	1,666	.15
Perryville-Rillito complex, 0 to 3 percent slopes	13,786	1.28
Pinal loam, 0 to 1 percent slopes	442	.04
Pinal loam, 1 to 3 percent slopes	502	.05
Pinal gravelly loam	15,165	1.41
Pinal-La Palma loams, 1 to 3 percent slopes	513	.05
Pinal-Suncity complex, 0 to 3 percent slopes	3,280	.30
Pinamt-Tremant complex, 1 to 10 percent slopes	3,910	.36
Rillito sandy loam, 0 to 1 percent slopes	2,319	.21
Rillito sandy loam, 1 to 3 percent slopes	360	.03
Rillito loam, 0 to 1 percent slopes	7,687	.71
Rillito loam, 1 to 3 percent slopes	715	.07
Rillito-Harqua complex, 1 to 3 percent slopes	6,585	.61
Rillito-Perryville complex, 5 to 20 percent slopes	5,431	.50
Rock outcrop-Cherioni complex	82,913	7.72
Toltec loam	484	.04
Torrifluvents	9,675	.90
Torriorthents	418	.04
Torripsamments and Torrifluvents, frequently flooded	3,976	.37
Tremant loam	3,598	.33
Tremant gravelly loam, 0 to 1 percent slopes	1,053	.10
Tremant gravelly loam, 1 to 3 percent slopes	615	.06
Tremant clay loam	980	.09
Tremant gravelly clay loam	549	.05
Tremant complex, 0 to 3 percent slopes	1,959	.18
Tremant-Rillito complex, 0 to 1 percent slopes	2,248	.21
Tremant-Rillito complex, 1 to 3 percent slopes	3,422	.32
Tremant-Rillito complex, 0 to 5 percent slopes	3,961	.37
Trix clay loam	4,449	.41
Tucson loam	6,105	.57
Tucson clay loam	4,879	.45
Valencia sandy loam	16,370	1.52

See footnotes at end of table.

TABLE 1.—*Approximate acreage and proportionate extent of the soils*—Continued

Soil	Acres	Percent [1]	Soil	Acres	Percent [1]
Valencia sandy loam, saline-alkali	1, 499	0. 14	Wintersburg complex	1, 378	0. 13
Valencia gravelly sandy loam	355	. 03	Borrow pits	655	. 06
Vecont loam	901	. 08	Dumps	149	. 01
Vecont clay	4, 691	. 44	Gravel pits	1, 261	. 11
Vint loamy fine sand	4, 107	. 38	Surveyed at High Intensity	651, 106	
Vint fine sandy loam	5, 141	. 48	Surveyed at Low Intensity	424, 523	
Vint loam	996	. 09	Lakes and all other water	701	. 06
Vint clay loam	396	. 04			
Vint-Carrizo complex	686	. 06	Total	[2] 1, 076, 330	100. 00

[1] Figures were rounded to nearest hundredth.

[2] Acreage includes water.

describing soils can be found in the Glossary at the end of this survey, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (*5*).[2]

Agualt Series

The Agualt series consists of deep, well-drained soils. These soils formed in recent alluvium that was deposited on flood plains, low terraces, and alluvial fans. The alluvium was derived from a wide mixture of rock, including granite, granite-gneiss, andesite, and basalt. Slopes are 0 to 3 percent. Elevations are 800 to 1,500 feet. In areas not irrigated, the vegetation is creosotebush, cactus, annual weeds and grasses, and scattered mesquite and paloverde trees. The average annual rainfall is about 6 to 8 inches, the mean annual air temperature is 69° to 74° F, and the frost-free season is 250 to 300 days.

In a representative profile the soil is brown loam to a depth of about 27 inches and pale-brown sand to a depth of 60 inches. The soil is moderately alkaline throughout and in most places is calcareous throughout.

Premeability is moderate in the loamy upper part of the soil and very rapid in the sandy lower part. Runoff is slow, and the hazard of erosion is slight. The available water capacity is 5 to 7 inches. Roots penetrate to a depth of about 60 inches.

Agualt soils are used for irrigated crops, range, recreation, and wildlife. Irrigated crops are cotton, alfalfa, barley, safflower, sugar beets, sorghum, citrus, and vegetables.

Representative profile of Agualt loam, 200 feet east and 75 feet north of southwest corner of cultivated field SW¼SE¼SW¼ sec. 18, T. 2 N., R. 1 E.

Ap—0 to 11 inches, brown (10YR 5/3) loam, dark brown (10YR 3/3) when moist; massive; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; common fine and very fine roots; common very fine interstitial and tubular pores; common very fine mica flakes; strongly effervescent; moderately alkaline; abrupt, smooth boundary.

C1—11 to 27 inches, brown (10YR 5/3) loam, dark brown (10YR 3/3) when moist; massive; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; common fine and very fine roots; many very fine interstitial and tubular pores; common very fine mica flakes; strongly effervescent; few, fine, faint, light-gray (10YR 7/2) filaments of lime; moderately alkaline; abrupt, wavy boundary.

IIC2—27 to 60 inches, pale-brown (10YR 6/3) sand, brown (10YR 5/3) when moist; single grained; loose when dry, nonsticky and nonplastic when wet; few fine roots in upper part; many fine interstitial pores; many fine and very fine mica flakes; 5 percent fine waterworn gravel; slightly effervescent; moderately alkaline.

The soil is typically dry, but is sometimes moist in the upper part during July, August, and September. The Ap and C1 horizons have hue of 7.5YR and 10YR, value of 5 to 6 dry and 3 to 5 moist, and chroma of 2 through 4 dry and moist. They are very fine sandy loam or loam and have a few thin strata of finer and coarser material. The content of gravel ranges from 0 to about 10 percent. Lime filaments are few to common in the lower part of the C1 horizon. The IIC2 horizon is at a depth ranging from 20 to 39 inches, but is most commonly at 26 to 30 inches. It ranges from loamy sand to sand. In places this horizon is as much as 35 percent gravel. Thin strata of finer material are also common.

Agualt loam (Aa).—Areas of this soil are long and narrow and about 10 acres in size. Slopes are generally less than 1 percent, but range to 3 percent. Included in mapping are small areas of Gilman loam, 0 to 1 percent slopes; Maripo sandy loam; Antho sandy loam, 0 to 1 percent slopes; Carrizo gravelly sandy loam; and Laveen loam, 0 to 1 percent slopes. The total extent of all included soils does not exceed 15 percent.

This Agualt soil is used for grazing. Capability unit IIs–7 irrigated, subclass VIIs dryland; Loam Upland range site; horticultural group 4; wildlife habitat group 2 irrigated, 10 dryland.

Antho Series

The Antho series consists of deep, well-drained soils. These soils formed in recent alluvium deposited on alluvial fans and stream terraces. The alluvium was derived from a wide variety of rock, but was dominantly from granite. Slopes are generally less than 1 percent, but range to 3 percent. Elevations are 850 to 1,400 feet. In areas not cultivated, the vegetation is creosotebush, bursage, cactus, and scattered mesquite and paloverde trees. The precipitation is 6 to 8 inches, the mean annual air temperature is 69° to 74° F, and the frost-free season is 250 to 300 days.

In a representative profile the soil is light yellowish-brown and light-brown sandy loam to a depth of 47 inches and reddish-brown light sandy clay loam to a depth of 60 inches. The soil is slightly to strongly calcareous and moderately alkaline throughout. In places it is gravelly throughout.

[2] Italic numbers in parentheses refer to Literature Cited, p. 115.

Permeability is moderately rapid. Runoff is slow to medium, and the erosion hazard is slight to moderate. Roots penetrate to a depth of 60 inches.

Antho soils are used for irrigated crops, range, recreation, wildlife, and homesites. Irrigated crops are cotton, alfalfa, barley, sugar beets, sorghum, citrus, truck crops, and safflower.

Representative profile of Antho sandy loam, 0 to 1 percent slopes, 200 feet west and 110 feet north of southeast corner SW¼ sec. 16, T. 2 N., R. 1 W. in desert shrub area near Litchfield Park:

A1—0 to 1 inch, brown (10YR 5/3) light sandy loam, dark brown (10YR 5/3) when moist; weak, coarse, platy structure; slightly hard when dry, very friable when moist, nonsticky and nonplastic when wet; few very fine roots; common very fine tubular pores; slightly effervescent; moderately alkaline; abrupt, smooth boundary.

C1—1 to 13 inches, light yellowish-brown (10YR 6/4) light sandy loam, brown (10YR 4/3) when moist; massive; slightly hard when dry, very friable when moist, nonsticky and nonplastic when wet; many fine roots; common very fine tubular pores; slightly effervescent to noneffervescent; moderately alkaline; clear, smooth boundary.

C2—13 to 23 inches, light yellowish-brown (10YR 6/4) sandy loam, brown (10YR 4/3) when moist; massive; slightly hard when dry, very friable when moist, slightly sticky and nonplastic when wet; common very fine roots; common fine tubular pores; strongly effervescent; moderately alkaline; clear, smooth boundary.

C3—23 to 36 inches, light-brown (7.5YR 6/4) sandy loam, brown (7.5YR 5/4) when moist; massive; slightly hard when dry, very friable when moist, slightly sticky and nonplastic when wet; few very fine roots; common fine tubular pores; strongly effervescent; few fine faint filaments of lime; moderately alkaline; clear, smooth boundary.

C4—36 to 47 inches, light-brown (7.5YR 6/4) loamy sand, brown (7.5YR 5/4) when moist; massive; soft when dry, very friable when moist, slightly sticky and nonplastic when wet; few very fine roots; few interstitial pores; strongly effervescent; few fine faint filaments of lime; moderately alkaline; clear, wavy boundary.

IIB2tb—47 to 60 inches, reddish-brown (5YR 4/4) light sandy clay loam, reddish brown (5YR 4/4) when moist; massive; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; few very fine roots; common very fine and few fine tubular and many interstitial pores; few thin clay films in tubular pores; strongly effervescent; few fine faint filaments of lime; moderately alkaline.

The A and C horizons have hue of 10YR and 7.5YR, value of 5 to 7 dry and 4 to 5 moist, and chroma of 2 to 4 dry and moist. These horizons are sandy loam or gravelly sandy loam and are 0 to 35 percent gravel. Strata of finer and coarser material are common. In places the A1 horizon is noneffervescent. Lime filaments are few to common in the C3 and C4 horizons. In places the soil has no IIB2tb horizon.

Antho sandy loam, 0 to 1 percent slopes (AbA).—This level to nearly level soil is on broad alluvial fans and low stream terraces. Slopes are less than 1 percent. Runoff is slow, and the hazard of erosion is slight. Except in cultivated areas, surface drainage is provided by a dendritic pattern of shallow stream channels spaced at 100- to 300-foot intervals. Areas are long and narrow and about 25 acres in size.

This soil has the profile described as representative of the series. Included in mapping are small areas of Maripo sandy loam; Agualt loam; Valencia sandy loam; Estrella loam; Gilman loam, 0 to 1 percent slopes; Coolidge sandy loam; and a soil that is similar to the Antho soil but has an 8- to 10-inch loam surface layer. The total extent of all included soils seldom exceeds 15 percent.

This Antho soil holds 5 to 7 inches of water available to plants. It is used for irrigated crops, range, recreation, wildlife, and homesites. Irrigated crops are cotton, alfalfa, barley, sugar beets, sorghum, safflower, citrus (fig. 5), and truck crops. Capability unit IIs–4 irrigated, subclass VIIs dryland; Loam Upland range site; horticultural group 1; wildlife habitat group 2 irrigated, 11 dryland.

Antho sandy loam, 1 to 3 percent slopes (AbB).—This gently sloping soil is on broad alluvial fans. Slopes are 1 to 3 percent, but a few are short and are as much as 5 percent. Runoff is medium, and the erosion hazard is moderate. Except in cultivated areas, surface drainage is provided by a dendritic pattern of shallow stream channels spaced at 100- to 300-foot intervals. Areas are long and narrow and about 10 acres in size.

Included with this soil in mapping are small areas of Gilman loam, 0 to 1 percent slopes; Maripo sandy loam; Coolidge sandy loam; and Antho gravelly sandy loam, 1 to 3 percent slopes. The total extent of all included soils seldom exceeds 15 percent.

This Antho soil holds 5 to 7 inches of water available to plants. About half the acreage is cultivated and is used for cotton, alfalfa, safflower, small grain, and citrus. The rest is grazed. A small part of the city of Phoenix is on this soil. Capability unit IIe–4 irrigated, subclass VIIe dryland; Loam Upland range site; horticultural group 1; wildlife habitat group 2 irrigated, 11 dryland.

Antho sandy loam, saline-alkali (Ac).—This nearly level soil is on valley plains in the Harquahala Valley and in the area near Wintersburg. Slopes are less than 1 percent and are slightly convex. Unless cultivated, areas are somewhat hummocky and are drained by a dendritic pattern of shallow stream channels spaced at 100- to 300-foot intervals. Areas are long and narrow and about 20 acres in size.

This soil has a profile similar to the one described as representative of the series, but is strongly alkaline at a depth of about 14 inches.

Included with this soil in mapping are small areas of Valencia sandy loam, saline-alkali; Gilman loam, saline-alkali; Laveen loam, saline-alkali; Antho sandy loam, 0 to 1 percent slopes; and Coolidge sandy loam. The total extent of all included soils seldom exceeds 20 percent.

The available water capacity is about 4 to 6 inches. Runoff is slow, and the hazard of erosion is slight.

Most of the acreage of this Antho soil is used for grazing. Irrigated crops are cotton, alfalfa, sorghum, and barley. Capability unit IIs–9 irrigated, subclass VIIs dryland; Saline Upland range site; horticultural group 5; wildlife habitat group 2 irrigated, 13 dryland.

Antho gravelly sandy loam, 0 to 1 percent slopes (AdA).—This level to nearly level soil is on the upper parts of alluvial fans and in overwash areas adjacent to stream channels. Slopes are less than 1 percent and are slightly convex. Unless cultivated, areas are drained by

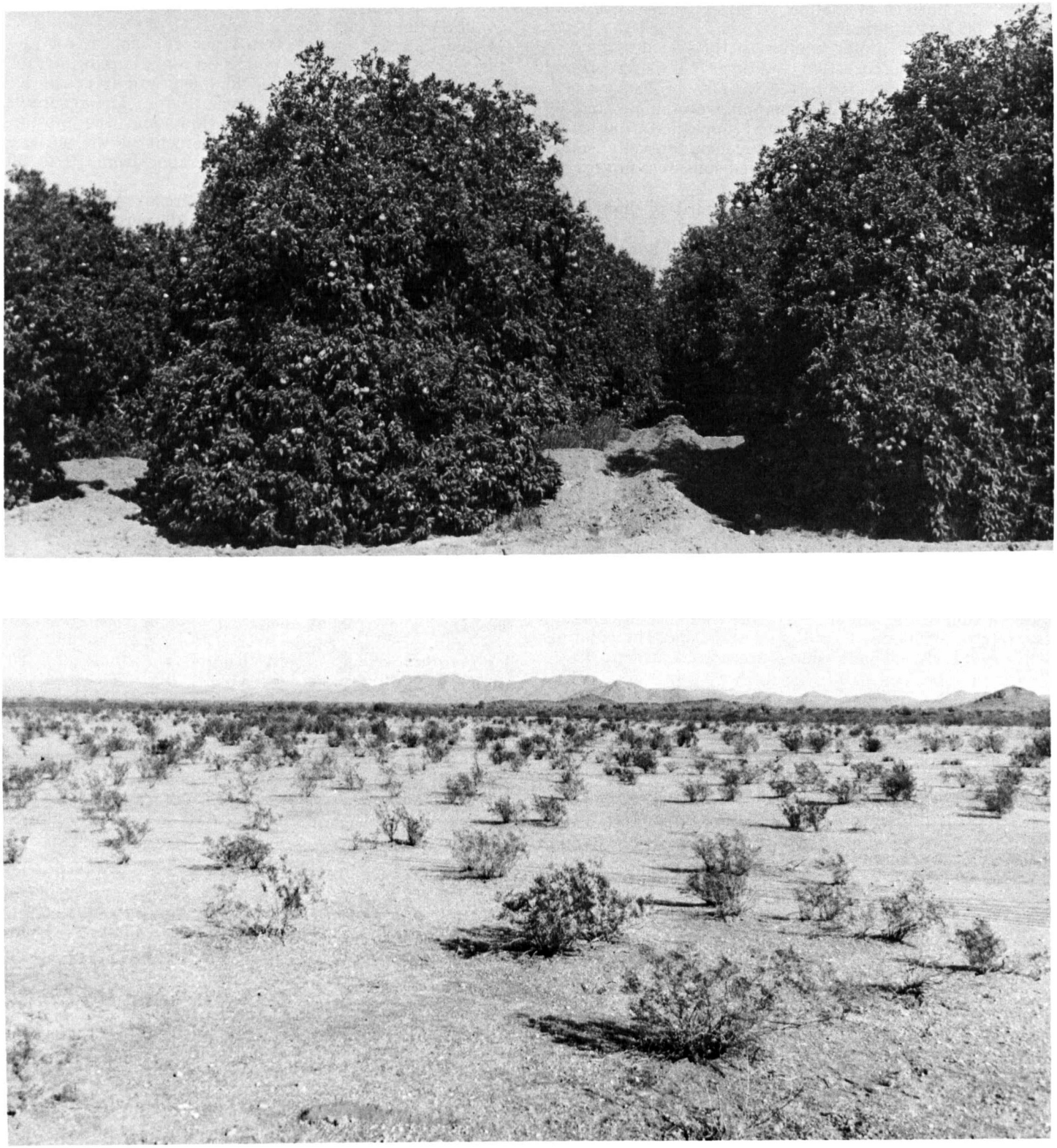

Figure 5.—Top: Citrus on Antho sandy loam. *Bottom:* Creosotebush on same soil.

a dendritic pattern of shallow stream channels spaced at 50- to 200-foot intervals.

This soil has a profile similar to the one described as representative of the series, but it is 15 to 55 percent gravel.

Included with this soil in mapping are small areas of Antho sandy loam, 0 to 1 percent slopes; Maripo sandy loam; Brios sandy loam; and Valencia gravelly sandy loam. The total extent of all included soils does not exceed 15 percent.

Runoff is slow, and the erosion hazard is slight. The available water capacity is 5 to 7 inches.

About half the acreage of this Antho soil is cultivated. Cotton, alfalfa, sorghum, barley, and citrus are the chief crops. The rest of the acreage is grazed. Capability unit IIs–4 irrigated, subclass VIIs dryland; Loam Upland range site; horticultural group 1; wildlife habitat group 2 irrigated, 11 dryland.

Antho gravelly sandy loam, 1 to 3 percent slopes (AdB).—This gently sloping soil is on the upper part of alluvial fans. Slopes are 1 to 3 percent and convex. Runoff is medium, and the erosion hazard is moderate. Surface drainage is provided by a dendritic pattern of shallow stream channels spaced at 50- to 150-foot intervals. Areas are long and narrow and about 10 acres in size. They parallel stream channels.

This soil has a profile similar to the one described as representative of the series, but it is 15 to 35 percent gravel.

Included with this soil in mapping are small areas of Valencia gravelly sandy loam; Rillito sandy loam, 1 to 3 percent slopes; Carrizo gravelly sandy loam; and Coolidge gravelly sandy loam, 1 to 3 percent slopes. The total extent of all included soils seldom exceeds 15 percent.

None of the acreage of this Antho soil is cultivated. It provides some grazing. Capability unit IIe–4 irrigated, subclass VIIe dryland; Loam Upland range site; horticultural group 1; wildlife habitat group 2 irrigated, 11 dryland.

Antho-Brios sandy loams (Ae).—This nearly level mapping unit is on broad alluvial fans and in the bottoms of broad intermittent stream channels. Slopes are less than 1 percent. Runoff is slow, and the erosion hazard is slight. Surface drainage is provided by a dendritic pattern of shallow stream channels spaced at 20- to 100-foot intervals. Areas are long and narrow and about 30 acres in size.

This mapping unit is about 45 percent Antho sandy loam, 0 to 1 percent slopes; 25 percent Brios sandy loam; and 20 percent Maripo sandy loam. The Brios soil occurs as long strips, 10 to 50 feet wide, that meander through larger areas of Antho soils. These strips form a braided pattern. The Maripo soil is in transitional areas between Brios and Antho soils. Included in mapping are a few small areas of Carrizo gravelly sandy loam, Gilman fine sandy loam, Agualt loam, and Valencia sandy loam. These included soils make up about 10 percent of the mapping unit.

Only about half the acreage is cultivated, and this acreage is within fields of better soils. The rest is grazed. Irrigated crops are cotton, alfalfa, sorghum, and grapes. Capability unit IIIs–7 irrigated, subclass VIIs dryland. Antho soil in Loam Upland range site; horticultural group 1; wildlife habitat group 2 irrigated, 11 dryland. Brios soil in Sandy Bottom range site; horticultural group 1; wildlife habitat group 4 irrigated, 11 dryland.

Antho-Carrizo complex, 0 to 1 percent slopes (AfA).—This nearly level mapping unit is on long, narrow stream terraces that parallel stream channels, and it is cut by one or more meandering channels. Slopes are generally less than 1 percent. Runoff is slow, and the erosion hazard is slight. About 30 to 40 percent of the surface area is covered with gravel. Areas range from 10 to 50 acres in size.

This mapping unit is about 50 percent Antho sandy loam, 0 to 1 percent slopes, and 30 percent Carrizo gravelly sandy loam. The Carrizo soil is in old stream channels that meander through larger areas of Antho soils. These channels are 2 to 5 feet above the present stream channel and ½ foot to 2 feet above the rest of the area. They form a braided pattern.

Included with this unit in mapping are small areas of Maripo sandy loam, Valencia sandy loam, Vint fine sandy loam, and Gilman fine sandy loam. The total extent of all included soils seldom exceeds 20 percent.

This mapping unit is sometimes used as range following seasonal rains. Few areas are cultivated. Irrigated crops are cotton, alfalfa, and citrus. Capability unit IVs–7 irrigated, subclass VIIs dryland. Antho soil in Loam Upland range site; horticultural group 1; wildlife habitat group 2 irrigated, 11 dryland. Carrizo soil in Sandy Bottom range site; horticultural group 4; wildlife habitat group 6 irrigated, 12 dryland.

Antho-Carrizo complex, 1 to 3 percent slopes (AfB).—This gently sloping mapping unit is on broad alluvial fans near the base of mountains. The largest area is in the Harquahala Valley near the base of the Big Horn Mountains. Slopes range from 1 to 3 percent but are dominantly 1½ to 2 percent. Runoff is medium, and the erosion hazard is moderate. About 30 to 40 percent of the surface area is covered with gravel and cobbles. Areas are oval in shape and range from 10 to 200 acres in size.

This mapping unit is about 40 percent Antho sandy loam, 1 to 3 percent slopes; 25 percent a Carrizo gravelly sandy loam that has 1 to 3 percent slopes; and 20 percent Maripo sandy loam that has 1 to 3 percent slopes. These soils have profiles similar to the ones described as representative of their respective series, but in some areas the Antho soil has a gravelly and cobbly stratum below a depth of 40 inches and the Maripo soil is gravelly throughout. The Carrizo soil occurs as long, narrow strips in old stream channels that meander through larger areas of Antho soils. These strips form a braided pattern. The Maripo soil is in transitional areas between Antho and Carrizo soils.

Included with this unit in mapping are small areas of Valencia gravelly sandy loam and Rillito sandy loam, 1 to 3 percent slopes. The total extent of all included soils seldom exceeds 15 percent.

This mapping unit is grazed. None of the acreage is cultivated. Capability subclass VIIe dryland; Antho soil in Loam Upland range site; horticultural group 1; wildlife habitat group 11 dryland. Carrizo soil in Sandy Bottom range site; horticultural group 4; wildlife habitat group 12 dryland.

Antho-Carrizo complex, 0 to 3 percent slopes (AGB).—This nearly level to gently sloping mapping unit is on alluvial fans that are 1 to 3 miles from the mountains and in some of the broader stream channels. Slopes are

mostly less than 1 percent, but a few convex ridges are more than 2 percent. In the more sloping parts, runoff is medium and the erosion hazard is moderate. Surface drainage is provided by a dendritic pattern of shallow stream channels spaced at 50- to 200-foot intervals. About 20 to 40 percent of the surface area is covered with gravel.

This mapping unit is about 35 percent an Antho sandy loam and an Antho gravelly sandy loam, 30 percent a Carrizo gravelly sandy loam, and 20 percent a Maripo sandy loam. The Carrizo soil is in or adjacent to old stream channels that form a braided pattern across larger bodies of Antho soils. The Maripo soil is in transitional areas between Carrizo and Antho soils.

Included with this unit in mapping are small areas of Brios sandy loam, Harqua gravelly loam, and Valencia sandy loam. The total extent of all inclusions seldom exceeds 15 percent.

This mapping unit provides grazing. Capability subclass VIIe dryland. Antho soils in Loam Upland range site; horticultural group 1; wildlife habitat group 11 dryland. Carrizo soil in Sandy Bottom range site; horticultural group 4; wildlife habitat group 12 dryland.

Antho-Tremant complex, 1 to 5 percent slopes (AHC).—This undulating mapping unit is on the upper part of alluvial fans that are ½ mile to 2 miles from the mountains. The largest area is on the east side of the White Tank Mountains. Slopes range from 1 to 5 percent. Runoff is medium, and the erosion hazard is moderate. Surface drainage is provided by a dentritic pattern of V-shaped stream channels spaced at 50- to 300-foot intervals. Areas range from 200 to 500 acres in size.

This mapping unit is about 40 percent an Antho gravelly sandy loam that has 1 to 5 percent slopes, and 30 percent a Tremant gravelly loam that has 1 to 3 percent slopes. The Antho soil has a profile similar to the one described as representative of the series, but it is 15 to 35 percent gravel. The Tremant soil has a profile similar to the one described as representative of the series, but the surface layer is gravelly loam 6 to 10 inches thick. The Antho soil is in slightly concave positions between stream channels and fan crests. The Tremant soil is on fan crests that are covered with a varnished desert pavement.

Included with this unit in mapping are small areas of Gunsight, Maripo, Rillito, Laveen, Carrizo, Mohall, Gilman, Valencia, and Estrella soils. The total extent of included soils does not exceed 30 percent of the unit.

This unit is not cultivated because slopes are complex. It provides grazing. Capability subclass VIIe dryland. Antho soil in Loam Upland range site; horticultural group 1; wildlife habitat group 11 dryland. Tremant soil in Loam Upland range site; horticultural group 2; wildlife habitat group 11 dryland.

Antho-Tremant-Mohall complex, 1 to 5 percent slopes (AkB).—This gently sloping to sloping mapping unit is on the upper parts of alluvial fans that are 1 mile to 3 miles from the base of the White Tank Mountains and other mountains. Elevation is generally more than 1,300 feet. Local relief is undulating, and slopes range from 1 to 5 percent. Runoff is medium, and the erosion hazard is moderate. A few slopes near stream channels are nearly 15 percent. On these, runoff is rapid. Surface drainage is provided by a dendritic pattern of V-shaped stream channels that are entrenched 5 to 25 feet. Areas are 200 to 400 acres in size.

This mapping unit is about 35 percent an Antho gravelly sandy loam that has 1 to 5 percent slopes; 15 percent Antho sandy loam, 1 to 3 percent slopes; 20 percent Tremant gravelly clay loam, 1 to 5 percent slopes, and 15 percent a Mohall gravelly sandy loam that has 0 to 1 percent slopes. These soils have profiles similar to the ones described as representative of their respective series, but the Antho gravelly sandy loam is 15 to 35 percent gravel and contains numerous thin strata of gravelly loamy sand and gravelly sand and the Mohall soil has a surface layer of gravelly sandy loam 5 to 10 inches thick. The Antho sandy loam and the Mohall and Tremant soils are on long, narrow convex ridges. From 40 to 90 percent of this surface area is covered with gravel and cobbles. The Antho sandy loam is in slightly concave depressional areas near stream channels.

Included with this unit in mapping are areas of Calciorthids and Torriorthents, eroded, along the margins of stream channels, where slopes range from 10 to 40 percent. Also included are a few small areas of Carrizo gravelly sandy loam and Gilman fine sandy loam. Included soils make up about 15 percent of this mapping unit.

This mapping unit provides grazing. None of the acreage is cultivated. Capability subclass VIIe dryland. Antho soils in Loam Upland range site; horticultural group 1; wildlife habitat group 11 dryland. Tremant soil in Loam Upland range site; horticultural group 2; wildlife habitat group 11 dryland. Mohall soil in Loam Upland range site; horticultural group 2; wildlife habitat group 11 dryland.

Antho association (AL).—This nearly level to gently sloping mapping unit is on alluvial fans that radiate out from nearby mountains. It occurs throughout the uncultivated part of the survey area, but is most extensive at the base of the Estrella Mountains in the Rainbow Valley. Slopes are generally less than 1 percent. Runoff is slow, and the erosion hazard is slight. A few slopes near stream channels are nearly 3 percent. On these, runoff is medium and the erosion hazard is moderate. Surface drainage is provided by a dendritic pattern of shallow stream channels, 1 foot to 3 feet deep, spaced at 50- to 300-foot intervals. Areas are somewhat pear shaped and range from 100 to 900 acres in size.

This mapping unit is about 55 percent an Antho sandy loam and 30 percent an Antho gravelly sandy loam. Antho gravelly sandy loam has a profile similar to the one described as representative of the series, but it is 15 to 35 percent gravel. Antho sandy loam is at the lower ends of alluvial fans farthest from the mountains. Antho gravelly sandy loam is on the higher parts of the alluvial fans nearest the mountains. Many of the more sloping areas have a few cobbles on the surface and in the profile.

Included with this unit in mapping are small areas of Coolidge sandy loam, Laveen sandy loam, Valencia sandy loam, Carrizo gravelly sandy loam, Maripo sandy loam, and Rock outcrop. The total extent of included soils seldom exceeds 15 percent of the unit.

This unit is grazed. None of the acreage is cultivated. Capability subclass VIIs dryland; Loam Upland range site; horticultural group 1; wildlife habitat group 11 dryland.

Antho-Valencia association (AM).—This mapping unit is on long, smooth valley plains that are 1 mile to 3 miles

from the base of the mountains. Slopes are 0 to 1 percent. Runoff is slow, and the erosion hazard is slight. Surface drainage is provided by a dendritic pattern of shallow stream channels, 1 foot to 3 feet deep, spaced at 50- to 200-foot intervals. Areas range from 200 to 2,000 acres in size.

This mapping unit is about 40 percent Antho sandy loam, 0 to 1 percent slopes, and 40 percent Valencia sandy loam.

Included with this unit in mapping are small areas of Coolidge sandy loam, Mohall sandy loam, and Gilman fine sandy loam. These included soils make up about 20 percent of the unit.

This mapping unit is grazed. None of the acreage is cultivated. Antho soil in capability subclass VIIs dryland; Valencia soil in capability subclass VIIc dryland. Both soils in Loam Upland range site; horticultural group 1; wildlife habitat group 11 dryland.

Avonda Series

The Avonda series consists of deep, well-drained soils on stream terraces and valley plains. These soils formed in recent mixed alluvium derived from acid and basic rocks, limestone, quartzite, and schist. They are mostly along the Gilea, Salt, and Agua Fria Rivers. Slopes are less than 1 percent. Elevations are 750 to 1,200 feet. The vegetation is creosotebush, mesquite, saltcedar, and annual weeds and grasses. The precipitation is 6 to 8 inches, the mean annual air temperature is 69° to 74° F, and the frost-free season is 250 to 290 days.

In a representative profile the surface layer is grayish-brown clay loam about 13 inches thick. The underlying material is light-brown loam to a depth of 27 inches and pinkish-gray and light-brown loam to a depth of 60 inches. The soil is moderately alkaline throughout and is weakly effervescent.

Permeability is moderately slow. Runoff is medium to slow, and the erosion hazard is slight. The available water capacity is 6 to 7 inches. Roots penetrate to a depth of about 60 inches.

Avonda soils are used for irrigated crops, range, recreation, and wildlife. Irrigated crops are cotton, alfalfa, barley, safflower, sorghum, and sugar beets.

Representative profile of Avonda clay loam, 2,730 feet south and 530 feet west of northeast corner sec. 4, T. 1 S., R. 3 W., in a cultivated field east of Buckeye:

Ap—0 to 13 inches, grayish-brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) when moist; weak, fine and medium, granular structure; slightly hard when dry, friable when moist, sticky and plastic when wet; common fine and very fine roots; few fine and very fine tubular and few medium interstitial pores; slightly effervescent; moderately alkaline; abrupt, smooth boundary.

C1—13 to 27 inches, light-brown (7.5YR 6/4) loam or very fine sandy loam, dark brown (7.5YR 4/4) when moist; massive; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; common very fine and fine roots; common very fine and fine tubular and common very fine interstitial pores; common mica flakes; strongly effervescent; moderately alkaline; clear, smooth boundary.

IIC2—27 to 60 inches, pinkish-gray (7.5YR 6/2) and light-brown (7.5YR 6/4) loamy coarse sand, brown (7.5YR 5/4) when moist; single grained; loose when dry and moist, nonsticky and nonplastic when wet; few very fine roots; many fine and coarse interstitial pores; few fine gravel; strongly effervescent; moderately alkaline.

Hue is 7.5YR and 10YR. The Ap horizon has value of 4 to 5 dry and 3 moist and chroma of 2 to 3 dry and moist. The A horizon is clay loam or silty clay loam. The C1 horizon has value of 5 to 6 dry and 3 to 5 moist and chroma of 3 to 4 dry and moist. The C2 horizon is loam or very fine sandy loam. In places filaments or threads of lime are common in the lower part of the C2 horizon. The IIC2 horizon has value of 6 or 7 dry and 4 or 5 moist and chroma of 3 or 4 dry and moist. The IIC2 horizon is loamy fine sand or coarser textured. Some soils are gravelly, but the gravel content is less than 15 percent. Some commonly are thinly stratified with finer textured material.

Avonda clay loam (An).—This soil is in long, narrow areas about ¼ to 1 mile from, and parallel to, major stream channels. Slopes are less than 1 percent. Areas range from 5 to 100 acres in size. Included in mapping are small areas of Avondale clay loam, Glenbar clay loam, Agualt loam, and Gilman loam, 0 to 1 percent slopes. The total extent of included soils seldom exceeds 25 percent.

This soil is used for range. Capability unit IIs–7 irrigated, subclass VIIs dryland; Sandy Bottom range site; horticultural group 4; wildlife habitat group 1 irrigated, 11 dryland.

Avondale Series

The Avondale series consists of deep, well-drained soils on stream terraces and alluvial plains. These soils formed in recent alluvium derived from basic and acid igneous rocks, quartzite, schist, and limestone. They are in the Buckeye and Salt River Valleys. Slopes are less than 1 percent. Elevations are 750 to 1,350 feet. In areas not cultivated the vegetation is creosotebush, saltcedar, mesquite, annual weeds, and grasses. The precipitation is 6 to 8 inches, the mean annual air temperature is 69° to 74° F, and the frost-free season is 250 to 300 days.

In a representative profile the surface layer is brown clay loam about 12 inches thick. The underlying material is pale brown to a depth of 60 inches. The soil is moderately alkaline and strongly effervescent throughout. In a few areas it is saline and very strongly alkaline.

Permeability is moderate or moderately slow. Runoff is slow, and the erosion hazard is slight. Roots penetrate to a depth of 60 inches.

Avondale soils are used for irrigated crops, range, recreation, and wildlife. Irrigated crops are cotton, alfalfa, barley, safflower, sorghum, sugar beets, grapes, citrus, and truck crops. Some areas are used as homesites.

Representative profile of Avondale clay loam, northwest corner SE¼NW¼ sec. 34, T. 1 N., R. 2 W., in a cultivated field:

Ap—0 to 12 inches, brown (10YR 5/3) clay loam, dark brown (10YR 3/3) when moist; weak, fine, subangular blocky structure; slightly hard when dry, friable when moist, sticky and plastic when wet; many very fine roots; common fine and very fine interstitial pores; strongly effervescent; moderately alkaline; abrupt, smooth boundary.

C1—12 to 37 inches, pale-brown (10YR 6/3) loam, brown (10YR 4/3) when moist; massive; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; common very fine roots; many very fine and common fine tubular pores; common mica flakes; strongly effervescent; few fine filaments of lime; moderately alkaline; clear, smooth boundary.

C2—37 to 60 inches, pale-brown (10YR 6/3) loam or very fine sandy loam, brown (10YR 4/3) when moist; massive; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; few very fine roots; many very fine tubular pores; strongly effervescent; few fine filaments of lime; moderately alkaline.

Generally the soil is no more than 3 percent coarse fragments. The A and C horizons have hue of 7.5YR to 10YR. The A horizon has value of 4 to 5 dry and 3 moist and chroma of 2 to 3 dry and moist. It is clay loam or silty clay loam and is more than 1 percent organic matter. The C horizon has value of 5 to 6 dry and 3 to 4 moist and chroma of 3 or 4 dry and moist. It is dominantly loam, but has a few ½- to 2-inch layers of sandy loam, very fine sandy loam, and clay loam. Lime filaments or threads are none to common in the C2 horizon. The soil contains few to many mica flakes.

Avondale clay loam (Ao).—This level and nearly level soil is on alluvial plains and low stream terraces. Slopes are less than 1 percent. Areas are long and narrow and about 60 acres in size.

This soil has the profile described as representative of the series. Included in mapping are small areas of Glenbar clay loam; Gilman loam, 0 to 1 percent slopes; and Trix clay loam. The total extent of included soils seldom exceeds 15 percent.

This Avondale soil holds 9 to 11 inches of water available to plants. It is used for irrigated crops and for range, recreation, and wildlife. Irrigated crops are cotton, alfalfa, barley, sorghum, sugar beets, safflower, grapes, citrus, and truck crops. Extensive areas occur in the cities of Phoenix, Glendale, and Buckeye. Capability unit I–1 irrigated, subclass VIIc dryland; Sandy Bottom range site; horticultural group 1; wildlife habitat group 1 irrigated, 11 dryland.

Avondale clay loam, saline-alkali (Ap).—This nearly level soil is on stream terraces along the margins of the Gila and Salt Rivers. Slopes are less than 1 percent. Areas are long narrow and range from 10 to 50 acres in size.

This soil has a profile similar to the one described as representative of the series, but it is moderately saline to strongly saline and moderately alkaline to strongly alkaline. Included in mapping are small areas of Glenbar clay loam, saline-alkali; Cashion clay, saline-alkali; and Gilman loam, saline-alkali.

This Avondale soil holds 6 to 8 inches of water available to plants. It is used for irrigated crops, range, recreation, and wildlife. Irrigated crops are cotton, alfalfa, barley, sorghum, sugar beets, and safflower. A few areas are used as homesites. Capability unit IIs–9 irrigated, subclass VIIs dryland; Sandy Bottom range site; horticultural group 5; wildlife habitat group 1 irrigated, 11 dryland.

Beardsley Series

The Beardsley series consists of moderately deep, well-drained soils that are 20 to 40 inches deep over an indurated hardpan. These soils formed on old alluvial fans and stream terraces. The alluvium was derived from a wide mixture of rock, including andesite, granite, granite-gneiss, quartzite, and schist. Slopes are less than 1 percent. Elevations are 1,200 to 1,400 feet. The native vegetation is galleta and mesquite and paloverde trees. The average annual rainfall is 6 to 8 inches, the mean annual air temperature is 69° to 74° F, and the frost-free season is 250 to 300 days.

In a representative profile the surface layer is light-brown loam about 3 inches thick. The subsoil is reddish-brown clay loam and clay that extends to a depth of about 36 inches. It rests on an indurated hardpan that is impervious to roots and water. The soil is moderately alkaline throughout and strongly effervescent in the lower part of the subsoil.

Permeability of the subsoil is slow. Runoff is slow, and there is no erosion hazard. The available water capacity is 5 to 6 inches. Roots penetrate to a depth of 24 to 40 inches.

Beardsley soils are grazed.

Representative profile of Beardsley loam, 1,000 feet west and 660 feet south of northeast corner of sec. 8, T. 4 N., R. 1 E. in an uncultivated area north of Sun City:

A1—0 to 3 inches, light-brown (7.5YR 6/4) loam, dark brown (7.5YR 4/4) when moist; weak, thin, platy structure; slightly hard when dry, friable when moist, slightly sticky and plastic when wet; common fine roots; common fine vesicular and few fine tubular pores; noneffervescent; moderately alkaline; abrupt, smooth boundary.

B1—3 to 10 inches, reddish-brown (5YR 5/4) clay loam, reddish brown (5YR 4/4) when moist; weak, medium, subangular blocky structure; hard when dry, friable when moist, sticky and plastic when wet; common very fine and fine roots; few fine tubular and few very fine interstitial pores; noneffervescent; moderately alkaline; clear, wavy boundary.

B2t—10 to 36 inches, reddish-brown (5YR 5/4) clay, reddish brown (5YR 4/4) when moist; moderate, coarse, subangular blocky structure; very hard when dry, firm when moist, sticky and very plastic when wet; common fine roots in upper part and common very fine roots in lower part; few thin clay films on faces of peds; many pressure faces or small slickensides on faces of peds; strongly effervescent; few, very fine, soft, pinkish-white (7.5YR 8/2) lime masses; moderately alkaline; abrupt, wavy boundary.

Csicam—36 to 60 inches, light brownish-gray (10YR 6/2), white (10YR 8/2), and light-gray (10YR 7/2) indurated silica-lime cemented duripan and thin laminar layer on upper surface; massive; extremely hard; violently effervescent.

Thickness of the solum and depth to the duripan range from 20 to 40 inches, but are dominantly 30 to 40 inches. The duripan ranges from 6 to 24 inches or more in thickness. It is fractured in places. The A horizon has hue of 7.5YR and 10YR, value of 5 or 6 dry and 3 or 4 moist, and chroma of 3 or 4. A thin, light-colored A2 horizon occurs in places. The B horizon has hue of 5YR or 7.5YR, value of 4 to 6 dry and 4 or 5 moist, and chroma of 3 to 6. It ranges from heavy clay loam to clay. A few thin strata that range from 15 to 40 percent gravel occur in places, but the average is less than 15 percent coarse fragments by volume. The Bt horizon ranges from weak to moderate, medium to fine, prismatic or weak to moderate, medium to coarse, subangular or angular blocky.

Beardsley loam (BE).—This soil occurs as long, narrow areas about 400 acres in size. In a few areas the surface is gravelly. Slopes are less than 1 percent and slightly concave. Included in mapping are small areas of Vecont clay, Suncity very gravelly loam, Pinal gravelly loam, and Beardsley gravelly loam.

This Beardsley soil provides grazing. Capability subclass VIIs dryland; Clay Bottom range site; horticultural group 7; wildlife habitat group 9 dryland.

Brios Series

The Brios series consists of deep, somewhat excessively drained soils. These soils formed in recent alluvium deposited on flood plains, low terraces, and alluvial fans.

The alluvium was derived from rhyolite, andesite, quartzite, and limestone. The surface is hummocky in some places. Slopes are 0 to 3 percent. The native vegetation is a sparse stand of creosotebush, cactus, annual weeds and grasses, and scattered mesquite, paloverde, and tamarix trees. Elevations are 700 to 1,300 feet. The climate is arid continental. The annual rainfall is 6 to 8 inches, the mean annual air temperature is about 69° to 74° F, and the frost-free season ranges from 250 to 300 days.

In a representative profile the surface layer is brown sandy loam about 14 inches thick. The underlying material to a depth of 60 inches is brown coarse sand that is stratified below a depth of 22 inches. The soil is moderately alkaline throughout. The surface layer is strongly effervescent, and the underlying material is slightly effervescent.

Permeability is rapid. Runoff is slow, and the erosion hazard is slight. The available water capacity is 4 to 5 inches. Roots penetrate to a depth of 60 inches. Flooding is a hazard in many places.

Brios soils are occasionally used for irrigated crops, such as pasture, small grain, cotton, alfalfa, citrus, grapes, and truck crops. They are also used for range, recreation, and wildlife and as a source of sand for construction. Some areas are used as homesties.

Representative profile of Brios sandy loam, 65 feet south and 228 feet east of northwest corner of NW¼ sec. 10, T. 2 N., R. 2 W. in a cultivated field west of Luke Air Force Base:

Ap—0 to 14 inches, brown (10YR 5/3) sandy loam, dark brown (10YR 4/3) when moist; massive; slightly hard when dry, very friable when moist, nonsticky and nonplastic when wet; common fine roots; common very fine tubular pores; 5 percent fine and medium gravel; strongly effervescent; moderately alkaline; abrupt, smooth boundary.

C1—14 to 22 inches, brown (10YR 5/3) coarse sand, dark brown (10YR 4/3) when moist; massive; slightly hard when dry, very friable when moist, nonsticky and nonplastic when wet; many fine interstitial pores; 5 to 10 percent fine to medium gravel; slightly effervescent; moderately alkaline; abrupt, wavy boundary.

C2—22 to 60 inches, brown (10YR 5/3), stratified coarse sand and gravelly coarse sand and thin strata of fine sandy loam and sandy loam, dark brown (10YR 4/3) when moist; single grained; loose when dry, loose when moist, nonsticky and nonplastic when wet; many fine interstitial pores; 10 to 20 percent well-rounded gravel; slightly effervescent; moderately alkaline.

The A and C horizons have hue of 10YR and 7.5YR, value of 5 to 6 dry and 4 through 5 moist, and chroma of 2 to 4 dry and moist. The A horizon is loam, sandy loam, fine sandy loam, loamy sand, and sand. A few fine pebbles occur, but generally are less than 10 percent by volume. The C horizon between depths of 12 and 40 inches is sand, gravelly sand, or gravelly loamy sand and a few, less than 2-inch layers of sandy loam or fine sandy loam material. The content of coarse fragments ranges from 0 to 35 percent by volume, but is commonly about 10 percent. Lime filaments or threads are evident in some places, as well as a few mica flakes.

Brios loamy sand (Br).—This soil is on flood plains and in a few areas on low alluvial fans. It occurs throughout the survey area. In many places the surface is hummocky. Slopes are dominantly less than 1 percent, but in a few places they are short and are nearly 3 percent. Areas are long and narrow and about 30 acres in size.

This soil has a profile similar to the one described as representative of the series, but the surface layer is dominantly loamy sand 5 to 12 inches thick and in places it is sand.

Included in mapping are small areas of Carrizo gravelly sandy loam and Vint loamy fine sand. Also included are a few small areas adjacent to the Gila River where the soil is slightly saline.

This Brios soil is used for grazing. Soil blowing is a slight hazard. The only cultivated acreage is within fields of better soils. Irrigated crops are cotton, alfalfa, pasture grass, and citrus. A few areas provide a source of sand. Capability unit IVs–7 irrigated, subclass VIIs dryland; Sandy Bottom range site; horticultural group 4; wildlife habitat group 6 irrigated, 11 dryland.

Brios sandy loam (Bs).—This soil is on low terraces near the major drainageways and on alluvial fans. It occurs throughout the survey area. The surface is somewhat hummocky. Slopes are less than 1 percent. Areas are long and narrow and about 10 acres in size.

This soil has the profile described as representative of the series. Included in mapping are small areas of Vint fine sandy loam, Carrizo gravelly sandy loam, Maripo sandy loam, and Antho sandy loam. Also included are small areas of Brios sandy loam that have a layer of clay loam below a depth of 30 inches, areas that have a surface layer of gravelly sandy loam, and a few areas near the Gila River where the soil is slightly saline. The total of all included soils seldom exceeds 20 percent.

The only cultivated acreage is within fields of better soils. Irrigated crops are cotton, alfalfa, small grain, truck crops, and citrus. The soil is also used for grazing and in a few places as a source of sand. Capability unit IIIs–7 irrigated, subclass VIIs dryland; Sandy Bottom range site; horticultural group 4; wildlife habitat group 4 irrigated, 11 dryland.

Brios loam (Bt).—This soil is on low terraces near major drainagways and on low alluvial fans. Slopes are less than 1 percent. Areas are long, narrow, and slightly concave. They are about 9 acres in size.

This soil has a profile similar to the one described as representative of the series, but the surface layer is loam 5 to 12 inches thick. Included in mapping are small areas of Antho sandy loam, 0 to 1 percent slopes; Maripo sandy loam; Carrizo gravelly sandy loam; Vint clay loam; and Vint loam. Also included are a few small areas where the soils are slightly saline to moderately saline. The total extent of all included soils seldom exceeds 20 percent.

The only cultivated acreage is within fields of better soils. Irrigated crops are cotton, alfalfa, small grain, and pasture grasses. The soil is used mainly for grazing. Capability unit IIIs–7 irrigated, subclass VIIs dryland; Sandy Bottom range site; horticultural group 4; wildlife habitat group 4 irrigated, 11 dryland.

Calciorthids and Torriorthents, Eroded

Calciorthids and Torriorthents, eroded (CA2), is in long, narrow areas at the steep edges of old alluvial fans and old stream terraces that slope abruptly down to recent stream terraces and flood plains below. The difference in elevation from the top to the bottom is generally more than 20 percent, but less than 80 feet. Slopes range from 15 to 40 percent. Areas are sharply dissected by arroyos that are commonly at right angles to the long axis of mapped areas. Calciorthids and Torriorthents, eroded,

run parallel to and are one-eighth to one-fourth mile from the main stream channels.

Calciorthids and Torriorthents, eroded, is highly variable remnants of old soils that were derived from mixed acid and basic igneous and some sedimentary rocks. It ranges from loamy sand to clay loam, is 35 to 85 percent gravel and cobbles, and is mainly very calcareous. Stones are on the surface in some areas. Included in mapping in some more gently sloping areas are small areas of Gunsight or Pinal soils. They make up less than 10 percent of the mapping unit.

Calciorthids and Torriorthents, eroded, provide a source of gravel and road fill, and some are used for grazing. Capability subclass VIIe dryland; Loam Upland range site; horticultural group 6; wildlife habitat group 12 dryland.

Carrizo Series

The Carrizo series consists of deep, excessively drained soils. These soils formed in recent alluvium deposited on flood plains along the major streams and along stream channels in alluvial fans. The alluvium was derived from a wide mixture of rock, including granite, granite-gneiss, andesite, and basalt. Slopes are mainly less than 5 percent, but range from 0 to 12 percent. Elevations are 750 to 1,400 feet. In areas not cultivated the vegetation is creosotebush, Indian ricegrass, six-weeks fescue, and scattered mesquite, paloverde, ironwood, and tamarix trees. The climate is arid continental. The average annual rainfall is 6 to 8 inches, the mean annual air temperature is 69° to 74° F, and the frost-free season is 250 to 300 days.

In a representative profile the surface layer is yellowish-brown gravelly sandy loam about 5 inches thick. The underlying material is pale-brown very gravelly loamy coarse sand and very gravelly coarse sand to a depth of 60 inches. The profile is moderately alkaline throughout and is weakly to moderately calcareous.

Permeability is rapid. Runoff is slow, and the erosion hazard is slight. The available water capacity is 2 to 4 inches. Roots penetrate to a depth of 60 inches. The soils are subject to occasional flooding.

Carrizo soils are seldom cultivated, but are used for range and wildlife and as a source of sand and gravel.

Representative profile of Carrizo gravelly sandy loam, 138 feet west and 200 feet south of the northeast corner of the SW¼ sec. 23, T. 4 N., R. 1 E. in a citrus grove north of Peoria:

Ap—0 to 5 inches, yellowish-brown (10YR 5/4) gravelly sandy loam, brown (10YR 4/3) when moist; massive; slightly hard when dry, very friable when moist, nonsticky and nonplastic when wet; few fine tubular and interstitial pores; 15 percent gravel and 3 percent cobbles; strongly effervescent; moderately alkaline; abrupt, smooth boundary.

C1—5 to 17 inches, pale-brown (10YR 6/3) very gravelly loamy coarse sand, brown (10YR 5/3) when moist; single grained; loose when dry; many fine interstitial pores; 38 percent gravel and 15 percent cobbles; strongly effervescent; moderately alkaline; clear, wavy boundary.

C2—17 to 25 inches, pale-brown (10YR 6/3) very gravelly coarse sand, brown (10YR 5/3) when moist; single grained; loose when dry; many fine interstitial pores; 38 percent gravel and 20 percent cobbles; slightly effervescent; moderately alkaline; clear, wavy boundary.

C3—25 to 60 inches, pale-brown (10YR 6/3) very gravelly coarse sand, dark yellowish brown (10YR 4/4) when moist; single grained; loose when dry; many fine interstitial pores; 35 percent gravel and 10 to 15 percent cobbles; slightly effervescent; moderately alkaline.

The soil is slightly to strongly effervescent. Hue of the Ap and C horizons is 10YR to 7.5YR, value is 5 to 7 dry and 4 or 5 moist, and chroma is 3 or 4 dry and moist. The A horizon is gravelly fine sandy loam, gravelly sandy loam, gravelly loamy sand, or gravelly sand. The content of coarse fragments ranges from slightly less than 15 to slightly more than 35 percent. The C horizon ranges from very gravelly coarse loamy sand to very gravelly coarse sand or sand. It is more than 35 percent coarse fragments. The coarse fragments are dominantly well-rounded pebbles and a few cobbles. Strata of finer textured material, ½ inch to 2 inches thick, are common in the C horizon.

Carrizo gravelly sandy loam (Cb).—This soil is in stream channels, on low terraces near stream channels, and on alluvial fans. It occurs throughout the survey area. Slopes are generally less than 1 percent, but in some undulating areas they are nearly 3 percent. Areas are long and narrow and are about 13 acres in size.

This soil has the profile described as representative of the series. Included in mapping are small areas of Maripo sandy loam; Brios loamy sand; Antho sandy loam, 0 to 1 percent slopes; Vint fine sandy loam; and Agualt loam. Also included are areas of other Carrizo soils that have a surface layer of loam, sand, or gravelly loam; and areas where a buried limy soil is below a depth of 30 inches. The total extent of all included soils seldom exceeds 15 percent.

This soil provides grazing and a source of sand and gravel for construction. It is used for irrigated crops only where it occurs within fields of better soils. Capability unit IVs–7 irrigated, subclass VIIs dryland; Sandy Bottom range site; horticultural group 4; wildlife habitat group 6 irrigated, 12 dryland.

Carrizo-Ebon complex, 3 to 12 percent slopes (CeD).—This gently sloping to moderately steep mapping unit is on alluvial fans, mainly at the base of the Salt River Mountains. Slopes range from 3 to 12 percent and are 400 to 2,000 feet long. The steeper slopes are mostly the short sides of deep drainageways that dissect the area at 50- to 300-foot intervals. The poorly sorted, very gravelly and cobbly underlying material is mainly derived from the granite-gneiss mountains.

This mapping unit is about 60 percent a Carrizo gravelly sandy loam that has 3 to 5 percent slopes and 30 percent an Ebon gravelly loam that has 3 to 12 percent slopes. Ebon soils are on long, narrow, slightly convex ridges that parallel long, narrow, slightly concave areas of Carrizo soils. Carrizo soils are in or near meandering stream channels, many of which are old and cut off and are now 1 foot to 5 feet above the present channel. Ebon soils are more prevalent at the lower and upper ends of the alluvial fans.

Included with this unit in mapping are a few small areas of Tremant gravelly clay loam, 3 to 5 percent slopes; areas of Rock outcrop; and some areas of soils, near the base of the South Mountains, that are shallow to moderately deep over a weakly to strongly lime cemented pan. Included soils make up about 10 percent of this mapping unit.

This mapping unit provides grazing. None of the acreage is cultivated. Capability subclass VIIe dryland. Carrizo

soil in Sandy Bottom range site; horticultural group 4; wildlife habitat group 12 dryland. Ebon soil in Clay Upland range site; horticultural group 3; wildlife habitat group 11 dryland.

Carrizo and Brios soils (CF).—This mapping unit is in or adjacent to channels of the Gila, Salt, and Hassayampa Rivers. It is hummocky and is dissected by many small stream channels and old meander cutoffs. Once every 5 to 20 years the lower lying areas are flooded. Flooding changes the soil material and occasionally the course of the main channel.

This mapping unit is typically about 45 percent Carrizo soil, 35 percent Brios soil, and 20 percent Vint soil. The Vint soil does not occur in some mapped areas, but is as much as 45 percent in others. These soils have profiles similar to the ones described as representative of their respective series, but their surface layer ranges from very gravelly sand to clay. The Carrizo soil is generally in slightly lower positions nearest to stream channels. The Vint soil, which is somewhat dunelike in appearance, is in slightly higher positions along the outer rim of most mapped areas. The Brios soil is in intermediate positions between the Carrizo and Vint soils. Included in mapping near Arlington are a few small areas of Gilman, Gadsden, Avondale, and Cashion soils.

This mapping unit is used for range, recreation, and wildlife. A few areas provide a source of sand and gravel. Capability subclass VIIs dryland. Carrizo soil in Sandy Bottom range site; horticultural group 4; wildlife habitat group 12 dryland. Brios soil in Sandy Bottom range site; horticultural group 4; wildlife habitat group 11 dryland.

Casa Grande Series

The Casa Grande series consists of deep, well-drained, strongly alkaline soils on alluvial plains bordering drainageways and on the lower part of broad alluvial fans. These soils formed in valley-fill alluvium derived from mixed material. Slopes are mainly less than 1 percent, but range from 0 to 2 percent. In areas not cultivated the vegetation is desert saltbush, mesquite, and cactus. Elevations are 850 to 1,300 feet. The climate is arid continental. The mean annual temperature ranges from 67 to 72° F, and the frost-free season is 250 to 300 days. The annual precipitation ranges from 6 to 8 inches and occurs as thundershowers from July to September and as gentle fall and winter rains.

In a representative profile the surface layer is reddish-yellow sandy loam about 1 inch thick. The subsoil is about 22 inches thick. It is dark reddish-brown, yellowish-red, reddish-yellow, and strong-brown clay loam and loam. The underlying material is yellowish-red and brown loam and sandy loam to a depth of 60 inches. The subsoil and underlying material contain filaments and soft masses of lime and are very strongly alkaline. In places the surface layer is loam.

Permeability is slow. Runoff is slow to very slow, and the hazard of erosion is slight. The available water capacity is 7 to 8 inches. Roots penetrate to a depth of 60 inches.

Casa Grande soils are used for irrigated crops, range, recreation, and wildlife. Irrigated crops are cotton, alfalfa, barley, sugar beets, sorghum, and safflower.

Representative profile of Casa Grande sandy loam, 1,120 feet east and 880 feet south of northwest corner sec. 18, T. 1 N., R. 8 W. in an uncultivated area in the Harquahala Valley:

A2—0 to 1 inch, reddish-yellow (7.5YR 6/6) sandy loam, strong brown (7.5YR 5/6) when moist; weak, thick, platy structure; slightly hard when dry, very friable when moist, nonsticky and slightly plastic when wet; few fine roots; many medium and coarse vesicular pores; strongly effervescent; moderately alkaline; abrupt, wavy boundary.

B21t—1 to 3 inches, dark reddish-brown (5YR 3/3) heavy loam, dark reddish brown (5YR 3/4) when moist; weak, coarse, prismatic structure; hard when dry, friable when moist, slightly sticky and plastic when wet; common fine and very fine roots; common fine vesicular pores; few thin clay films on faces of peds; slightly effervescent; very strongly alkaline; clear, wavy boundary.

B22tcasa—3 to 7 inches, yellowish-red (5YR 5/8) light clay loam, yellowish red (5YR 4/8) when moist; weak, medium, prismatic structure; hard when dry, friable when moist, slightly sticky and plastic when wet; common fine roots; common fine tubular pores; few thin clay films on faces of peds; common, fine, white (10YR 8/2) salt crystals; violently effervescent; few, fine, pinkish-white (7.5YR 8/2) filaments of lime and soft lime masses, pinkish gray (7.5YR 7/2) when moist; moderately alkaline; clear, wavy boundary.

B23tcasa—7 to 15 inches, reddish-yellow (5YR 6/8) clay loam, yellowish red (5YR 4/8) when moist; moderate, medium, subangular blocky structure; hard when dry, friable when moist, slightly sticky, plastic when wet; few fine roots; common fine tubular pores; common thin clay films on faces of peds; common, fine and medium, white (10YR 8/2) salt crystals; few, fine, black (5YR 2/1) coatings on faces of peds; violently effervescent; many, fine and medium, pinkish-white (7.5YR 8/2) filaments of lime and soft irregularly shaped lime masses, pink (7.5YR 8/4) when moist; very strongly alkaline; clear, wavy boundary.

B3casa—15 to 23 inches, strong-brown (7.5YR 5/8) light clay loam, strong brown (7.5YR 5/6) when moist; weak, medium, subangular blocky structure; hard when dry, friable when moist, slightly sticky, plastic when wet; few fine roots; common fine tubular pores; few, fine, white (10YR 8/2) gypsum cystals; violently effervescent; common, fine and medium, pinkish-white (7.5YR 8/2) filaments of lime and soft irregularly shaped lime masses, pink (7.5YR 8/4) when moist; very strongly alkaline; clear, smooth boundary.

C1casa—23 to 48 inches, yellowish-red (5YR 5/8) loam, yellowish red (5YR 4/8) when moist; massive; very hard when dry, friable when moist, slightly sticky, slightly plastic when wet; very few fine and medium roots; common fine tubular pores; violently effervescent; many, fine, pinkish-gray (5YR 7/2) filaments of lime and irregularly shaped soft lime masses, pinkish-gray (5YR 6/2) when moist; very strongly alkaline; clear, smooth boundary.

C2casa—48 to 60 inches, brown (7.5YR 5/4) sandy loam, dark brown (7.5YR 4/4) when moist; massive; slightly hard when dry, very friable when moist, slightly sticky, slightly plastic when wet; common fine tubular pores; violently effervescent; many, fine, pinkish-gray (7.5YR 7/2) filaments of lime and soft lime masses; very strongly alkaline.

The solum ranges from about 12 to 40 inches in thickness. The soil is generally dry unless irrigated. The B and C horizons are generally very strongly alkaline and in places are strongly saline. The content of calcium carbonate in the B and C horizons in most places is more than 15 percent; it ranges from 7 to 25 percent. Typically, the largest concentration of calcium carbonate is in the B2 horizon and it gradually decreases with increasing depth. In some places the largest concentration is in the Cca horizon.

An A1 horizon has hue of 7.5YR or 10YR, value of 6 to 7 dry and 3 to 4 moist, and chroma of 3 or 4 dry and moist. It ranges from coarse sandy loam to heavy loam. The A2 horizon has hue of 10YR or 2.5YR, value of 6 or 7 dry and 5 or 6 moist, and chroma of 3 to 6. It is loam and sandy loam. In

places the A2 horizon is a thin ashy coating on the top of the B21t horizon, and it is covered with a thin Al horizon that ranges from 1 to 8 inches in thickness.

The B horizon has hue of 7.5YR and 5YR, value of 3 to 6 dry and 3 through 5 moist, and chroma of 4 to 8 dry and moist. It is sandy clay loam or clay loam. The B21t and B22tcasa horizons are generally prismatic, but are subangular blocky in places. The B23tcasa and B3casa horizons are generally subangular blocky, but are massive in some places.

The C horizon has hue of 7.5YR, 5YR, or 10YR, value of 6 to 7 dry and 4 or 5 moist, and chroma of 3 to 8 dry and moist. It ranges from sand to clay loam and is stratified in places. In places a few durinodes are on the surface or are scattered throughout the profile.

Casa Grande sandy loam (Cg).—This nearly level soil is on the lower parts of old alluvial fans in the Rainbow and Harquahala Valleys and in the area near Wintersburg. It is hummocky, and in areas not cultivated the surface is partly covered with a dark-colored algal crust. Slopes are less than 1 percent. Surface drainage is provided by a dendritic pattern of shallow stream channels spaced at 200- to 1,000-foot intervals. Areas are long and narrow and range from 10 to 500 acres in size.

This soil has the profile described as representative of the series. Included in mapping are small areas of Laveen loam, saline-alkali; Harqua gravelly clay loam, 0 to 1 percent slopes; Valencia sandy loam, saline-alkali; Tucson loam, and some sand dunes. The total extent of all included soils does not exceed 15 percent.

This Casa Grande soil is used mainly for irrigated crops, recreation, and wildlife. Irrigated crops are cotton, alfalfa, barley, sugar beets, safflower, and sorghum. Some areas provide grazing. Capability unit IIIs–9 irrigated, subclass VIIs dryland; Saline Upland range site; horticultural group 5; wildlife habitat group 5 irrigated, 14 dryland.

Casa Grande loam (Ch).—This nearly level soil is on alluvial plains that parallel Centennial Wash in the Harquahala Valley and on old alluvial fans in the area near Wintersburg. It is hummocky and in areas not cultivated the surface is partly covered by a dark-colored algal crust. Many small accumulations of soil are deposited by wind around bushes. Slopes are less than 1 percent. Surface drainage is provided by a dendritic pattern of stream channels spaced at 150- to 1,000-foot intervals. Areas are long and narrow and range from 10 to 500 acres in size.

This soil has a profile similar to the one described as representative of the series, but the surface layer is loam or very fine sandy loam. Included in mapping are a few small areas of Laveen loam, saline-alkali; Estrella loam, saline-alkali; Harqua gravelly clay loam, 0 to 1 percent slopes; Tucson loam, and some small sand dunes. The total extent of all included soils does not exceed 15 percent.

This Casa Grande soil is used mainly for irrigated crops, recreation, and wildlife. Irrigated crops are cotton, alfalfa, barley, sugar beets, safflower, sorghum, and citrus. Some areas provide grazing. Capability unit IIIs–9 irrigated, subclass VIIs dryland; Saline Upland range site; horiticultural group 5; wildlife habitat group 5 irrigated, 14 dryland.

Casa Grande complex (Ck).—This level to nearly level mapping unit is on valley plains and at the lower ends of broad alluvial fans in the Harquahala Valley and in the area near Wintersburg. Slopes are generally less than 1 percent, but in a few ridge-shaped areas they are about 2 percent. Surface drainage is provided by a dendritic pattern of stream channels spaced at 100- to 500-foot intervals. Areas are long, narrow, and irregularly shaped and range from 20 to 300 acres in size.

This mapping unit is about 40 percent a Casa Grande sandy loam that has 0 to 1 percent slopes, and 35 percent a Casa Grande loam that has 0 to 1 percent slopes. These soils have profiles similar to the ones described as representative of their series, but their surface layer is sandy loam or loam. The Casa Grande sandy loam, which is hummocky, is in slightly higher positions. The Casa Grande loam is generally in lower positions. Its surface is smooth and has a slicked-over appearance as a result of sheet erosion. It is nearly devoid of vegetation. These soils occur in an intricate pattern and cannot be mapped separately.

Included with this unit in mapping are small areas of Laveen loam, saline-alkali; Harqua gravelly sandy loam, saline-alkali; and sand dunes. The total extent of all included soils does not exceed 25 percent of this mapping unit.

This mapping unit provides grazing. None of the acreage is cultivated. Capability subclass VIIs dryland; Saline Upland range site; horticultural group 5; wildlife habitat group 14 dryland.

Casa Grande-Laveen complex, alkali (Cm).—This nearly level mapping unit is on valley plains and old alluvial fans in the area near Wintersburg and along Centennial Wash in the Harquahala Valley. In places it is covered with a dark-colored algal crust, and in other places it has a slicked-over appearance. Slopes are generally less than 1 percent, but a few areas are hummocky and have short slopes of nearly 2 percent. Surface drainage is provided by a dendritic pattern of shallow stream channels spaced at 50- to 500-foot intervals. Areas are irregularly shaped and range from 5 to 100 acres in size.

This mapping unit is about 40 percent Casa Grande loam and 40 percent Laveen loam, saline-alkali. The Casa Grande soil has a profile similar to the one described as representative of the series, but the surface layer is loam in cultivated areas and is sandy loam and loam in areas not cultivated. The Laveen soil has a profile similar to the one described as representative of the series, but it is very strongly alkaline at a depth ranging from 8 to 30 inches. Also, its surface layer is fine sandy loam and loam in areas not cultivated.

Included with this unit in mapping are small areas of Gilman loam, saline-alkali, 0 to 1 percent slopes; Coolidge sandy loam, saline-alkali, 0 to 1 percent slopes; Estrella loam, saline-alkali; and a few small sand dunes. Also included are some areas of a soil that is transitional between the Casa Grande and Laveen soils and has a weakly formed subsoil. The total extent of included soils does not exceed 20 percent.

This mapping unit is used for irrigated crops and for grazing. Crops are cotton, alfalfa, barley, and sorghum. The Casa Grande soil is nearly devoid of vegetation in areas not cultivated. A few areas have been subdivided as homesites. Capability unit IIIs–9 irrigated, subclass VIIs dryland; Saline Upland range site; horticultural group 5; wildlife habitat group 5 irrigated, 14 dryland.

Cashion Series

The Cashion series consists of deep, well-drained soils. These soils formed in recent alluvium deposited on flood plains and low terraces along the Gila and Salt Rivers.

The alluvium was derived from a wide mixture of rock, including granite, granite-gneiss, andesite, basalt, and limestone. Slopes are 0 to 1 percent. Elevations are 700 to 1,100 feet. In areas not irrigated the vegetation is creosotebush, tamarix, saltbush, mesquite, annual weeds, and grasses. The average annual rainfall is about 6 to 8 inches, the mean annual air temperature is 69° to 74° F, and the frost-free season is 250 to 300 days.

In a representative profile the surface layer is dark grayish-brown clay about 27 inches thick. The underlying material is pale-brown very fine sandy loam and light yellowish-brown silt loam to a depth of 60 inches. The soil is moderately alkaline to strongly alkaline, is slightly saline to strongly saline, and is generally calcareous throughout.

Permeability is slow. Runoff is slow, and the erosion hazard is slight. The available water capacity is 9 to 10 inches. Roots penetrate to a depth of more than 5 feet. Once every 5 years for about 5 hours, the soils are subject to flooding in a few areas near the Gila River.

Cashion soils are used for irrigated crops, range, recreation, and wildlife. Irrigated crops are cotton, alfalfa, sorghums, wheat, barley, sugar beets, and safflower.

Representative profile of Cashion clay, saline-alkali, 1,620 feet east and 100 feet north of the west quarter corner of sec. 3, T. 1 S., R. 3 W. in a cultivated field southwest of Liberty:

Ap—0 to 10 inches, dark grayish-brown (10YR 4/2) clay, dark brown (10YR 3/2) when moist; weak, fine, subangular blocky structure; hard when dry, friable when moist, sticky and plastic when wet; common fine and very fine roots; common very fine and fine tubular and interstitial pores; strongly effervescent; moderately alkaline; clear, smooth boundary.

A1—10 to 27 inches, dark grayish-brown (10YR 4/2) clay, dark brown (10YR 3/2) when moist; weak, fine, subangular blocky structure; hard when dry, friable when moist, sticky and plastic when wet; common very fine and fine roots; common very fine and fine tubular and interstitial pores; strongly effervescent; moderately alkaline; clear, smooth boundary.

IIC1—27 to 29 inches, pale-brown (10YR 6/3) very fine sandy loam, dark brown (10YR 4/3) when moist; massive; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; common fine and very fine roots; many very fine tubular and interstitial pores; many mica flakes; strongly effervescent; moderately alkaline; clear, smooth boundary.

IIC2—29 to 60 inches, light yellowish-brown (10YR 6/4) light silt loam, dark yellowish brown (10YR 4/4) when moist; massive; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; few fine and very fine roots; common very fine and fine tubular and interstitial pores; many mica flakes; strongly effervescent; moderately alkaline.

The soil between depths of 10 and 40 inches is dry in most years. Depth to the IIC horizon is commonly 24 to 30 inches, but ranges from 20 to 39 inches. The soil is slightly saline to strongly saline. Few to many mica flakes, lime, and salt filaments occur throughout.

The A horizon has hue of 7.5YR and 10YR, value of 4 or 5 dry and 2 or 3 moist, and chroma of 2 to 4 dry and moist. It is clay and silty clay. The IIC horizon has value of 5 or 6 dry and 4 or 5 moist, and chroma of 2 to 4 dry and moist. It is loam, silt loam, very fine sandy loam, and fine sandy loam that has ½- to 2-inch layers of clay loam or silty clay loam.

Cashion clay, saline-alkali (Cn).—This smooth, nearly level soil is on flood plains and low stream terraces of the Gila and Salt Rivers. Slopes are less than 1 percent. Some areas are long and narrow strips that have a concave surface.

Included with this soil in mapping are small areas of Gadsden clay, Avondale clay loam, Wintersburg clay loam, and Glenbar clay loam. Also included are a few areas of soils near the mouth of the Hassayampa River where loamy sand or sandy loam is below a depth of 30 inches, a few small areas of soils in the southwestern part of Phoenix where the surface layer is clay loam 8 to 10 inches thick, and some areas of soils near Arlington Canal that are moderately well drained. The total extent of all included soils seldom exceeds 20 percent.

This Cashion soil provides grazing. Capability unit IVs–9 irrigated, subclass VIIs dryland; Sandy Bottom range site; horticultural group 3; wildlife habitat group 8 irrigated, 11 dryland.

Cherioni Series

The Cherioni series consists of well-drained soils that have a hardpan and are only 6 to 20 inches deep over basalt, andesite, granite or granite-gneiss bedrock. These soils formed on low hills and the lower slopes of mountains. Slopes range from 3 to 25 percent. Elevations are 800 to 1,800 feet. The native vegetation is creosotebush, cactus, mesquite, and paloverde trees. The average annual rainfall is 6 to 8 inches, the mean annual air temperature is 69° to 72° F, and the frost-free season is 270 to 325 days.

In a representative profile the surface layer is light yellowish-brown very gravelly loam about 1 inch thick. The underlying material is light yellowish-brown and very pale brown very gravelly loam about 5 inches thick. It rests on a white, silica-lime cemented hardpan about 6 inches thick. The pan cannot be broken by hand. Fractured andesite bedrock is just below the pan. The soil is moderately alkaline.

Permeability is moderate above the hardpan. Runoff is medium, and the erosion hazard is slight to moderate. The available water capacity is less than 2 inches. Roots penetrate to a depth of less than 20 inches.

Cherioni soils are used mainly for range. Several county parks are on these soils, and a few areas in the city of Phoenix are used as homesites.

Representative profile of Cherioni very gravelly loam in an area of Cherioni-Rock outcrop complex, 990 feet east and 1,485 feet south of northwest corner sec. 15, T. 1 S., R. 10 W. in an uncultivated area south of Eagle Tail Peak:

A1—0 to 1 inch, light yellowish-brown (10YR 6/4) very gravelly loam, dark yellowish brown (10YR 3/4) when moist; weak, thin, platy structure; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; common fine roots; common fine tubular and common fine interstitial pores; 80 to 90 percent angular gravel and pan fragments; strongly effervescent; moderately alkaline; clear, smooth boundary.

C1—1 to 6 inches, light yellowish-brown (10YR 6/4) and very pale brown (10YR 7/4) very gravelly loam, dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/4) when moist; massive; slightly hard when dry, very friable when moist; slightly sticky and slightly plastic when wet; common fine roots; common fine tubular and few fine interstitial pores; 50 percent angular, extremely hard, indurated, pan fragments; 20 percent angular rock gravel; violently effervescent; moderately alkaline; abrupt, wavy boundary.

C2sicam—6 to 12 inches, pinkish-white (7.5YR 8/2) and light-brown (7.5YR 6/4) extremely hard duripan, light brown (7.5YR 6/4) and pink (7.5YR 7/4) when moist; massive; ⅛-inch laminar layer on surface of pan; pan is 60 percent gravel; violently effervescent; moderately alkaline; abrupt, wavy boundary.

R—12 inches, extremely hard andesite bedrock that is fractured in places. Surface is coated with lime.

Depth to the indurated duripan ranges from 5 to 12 inches. Depth to bedrock ranges from 6 to 20 inches, but is dominantly 9 to 16 inches. These soils are generally dry, but are moist in places in summer, mainly in July, August, and September. The mean annual soil temperature ranges from 72° to 76° F. The duripan ranges from 1 to 8 inches in thickness.

The A1 and C1 horizons have hue of 10YR and 7.5YR and value of 6 or 7 dry and 3 to 5 moist. These horizons are loam, fine sandy loam, and very fine sandy loam. They range from 35 to 80 percent coarse fragments; the average content of coarse fragments is about 50 percent. About 5 to 30 percent of the coarse fragments are angular pieces of the duripan. In places a Cca horizon is just above the pan.

Cherioni-Rock outcrop complex (CO).—This mapping unit is on low hills and the lower slopes of mountains. It is dissected by low stream channels that have cut 3 to 20 feet below the surface. These channels are 50 to 200 feet apart. Gravel, cobbles, and stones cover 50 to 90 percent of the surface. Slopes are complex and range from 3 to 25 percent.

This mapping unit is about 50 percent a Cherioni very gravelly loam that has slopes of 3 to 25 percent and about 20 percent Rock outcrop. The Cherioni soil is on the lower slopes of mountains and low hills, and Rock outcrop is on the upper slopes.

Included with this unit in mapping are some areas of a very gravelly loam that has an accumulation of lime just above the bedrock. This soil is in similar positions to those of the Cherioni soil. Also included are areas of Gachado very gravelly clay loam, Pinal soils, Gunsight soils, and Rillito soils. These included soils seldom make up more than 30 percent of the mapping unit.

This mapping unit provides grazing. It is not cultivated. A few areas in the city of Phoenix are used as homesites. Capability subclass VIIe dryland. Loam Hills range site; horticultural group 7; wildlife habitat group 12 dryland.

Coolidge Series

The Coolidge series consists of deep, well-drained soils. These soils formed in alluvium deposited on old alluvial fans and valley plains. The alluvium was derived from granite, granite-gneiss, schist, limestone, andesite, rhyolite, tuff, and basalt. Slopes are 0 to 3 percent. Elevations are 800 to 1,400 feet. In areas not cultivated, the vegetation is creosotebush, annual weeds and grasses, bursage, cactus, and scattered mesquite and paloverde trees. The average annual rainfall is 6 to 8 inches, the mean annual air temperature is 69° to 74° F, and the frost-free season is 250 to 300 days.

In a representative profile the soil is light yellowish-brown sandy loam to a depth of about 24 inches and pale-brown sandy loam to a depth of 63 inches. The lower part contains filaments and nodules of lime. The soil is moderately alkaline throughout and is strongly to violently effervescent.

Permeability is moderately rapid. Runoff is medium to slow, and the erosion hazard is light to moderate. The available water capacity is 6 to 7 inches. Roots penetrate to a depth of 60 inches or more.

Coolidge soils are used for irrigated crops, range, recreation, and wildlife. Irrigated crops are cotton, alfalfa, barley, safflower, sorghum, sugar beets, citrus, and grapes. Parts of the cities of Phoenix and Buckeye are on these soils.

Representative profile of Coolidge sandy loam, 600 feet west and 207 feet north of the southeast corner NE¼ NE¼ sec. 8, T. 1 N., R. 2 W., in a cultivated field northwest of Perryville:

Ap—0 to 13 inches, light yellowish-brown (10YR 6/4) sandy loam, brown (10YR 4/3) when moist; massive; slightly hard when dry, friable when moist, nonsticky and nonplastic when wet; violently effervescent; moderately alkaline; abrupt, smooth boundary.

C1—13 to 24 inches, light yellowish-brown (10YR 6/4) sandy loam, dark yellowish brown (10YR 4/4) when moist; massive; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; few fine tubular pores; violently effervescent; many fine filaments of lime; moderately alkaline; abrupt, smooth boundary.

C2ca—24 to 42 inches, pale-brown (10YR 6/3) sandy loam, yellowish brown (10YR 5/4) when moist; massive; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; many fine tubular pores; violently effervescent; many white (10YR 8/2) filaments of lime and medium lime nodules; moderately alkaline; abrupt, wavy boundary.

C3ca—42 to 63 inches, pale-brown (10YR 6/3) sandy loam, brown (10YR 5/3) when moist; massive; very hard when dry, friable when moist, slightly sticky and slightly plastic when wet; few medium tubular pores; few pebbles; strongly to violently effervescent; many fine white filaments of lime and many medium lime nodules; moderately alkaline.

Depth to the calcic horizon ranges from 14 to 30 inches. The soil between depths of 10 and 40 inches averages sandy loam or fine sandy loam. The content of gravel averages less than 15 percent, but in any one strata it can be as much as 35 percent.

The soil has hue of 7.5YR and 10YR. The A horizon and C1 horizons have value of 5 or 6 dry and 4 or 5 moist and chroma of 3 or 4 dry and moist. The soil generally is sandy loam or fine sandy loam, but in places has a few ¼- to 1-inch strata of finer or coarser material in the C1 horizon. The Cca horizon has value of 5 to 7 dry and 3 to 5 moist and chroma of 2 to 4 dry and moist. It is dominantly sandy loam, but in places contains strata of loam or loamy sand. It contains soft powdery lime or is 5 to 10 percent lime nodules ¼ to ¾ inch in diameter, or both. It is more than 15 percent calcium carbonate. In places it is weakly cemented with lime.

Coolidge sandy loam (Cp).—This nearly level soil is on valley plains and alluvial fans. It occurs throughout the survey area, but is most extensive in the northern part of Buckeye Valley. Slopes are slightly convex and generally less than 1 percent, but in a few areas they are nearly 2 percent. Unless cultivated, areas are dissected by shallow stream channels at 50- to 300-foot intervals. They are long and narrow and about 55 acres in size.

This soil has the profile described as representative of the series. Included in mapping are small areas of Laveen sandy loam; Antho sandy loam, 0 to 1 percent slopes; Rillito sandy loam, 0 to 1 percent slopes; Perryville sandy loam; and Valencia sandy loam. Also included in the Harquahala Valley and near Tonopah and Wintersburg are a few areas where the soil is strongly alkaline. The total extent of all included soils seldom exceeds 20 percent.

This soil is used for cultivated crops and grazing. Irrigated crops are cotton, alfalfa, barley, safflower, sugar

beets, sorghum, citrus, and grapes. Capability unit IIs–7 irrigated, subclass VIIs dryland; Loam Upland range site; horticultural group 2; wildlife habitat group 2 irrigated, 11 dryland.

Coolidge gravelly sandy loam, 1 to 3 percent slopes (CrB).—This gently sloping soil is on old alluvial fans and low ridges. It occurs throughout the survey area. Slopes are slightly convex and generally about 2 percent, but some short slopes are as much as 6 percent. The erosion hazard is moderate. Areas are long and narrow and about 35 acres in size.

This soil has a profile similar to the one described as representative of the series, but the surface layer is gravelly sandy loam 6 to 14 inches thick.

Included with this soil in mapping are a few small areas of Rillito sandy loam, 1 to 3 percent slopes; Perryville sandy loam, 1 to 3 percent slopes; and Antho gravelly sandy loam, 1 to 3 percent slopes. Also included are a few areas of soils that are very strongly saline and alkaline in the lower part.

This Coolidge soil is grazed, but is seldom cultivated. Capability unit IIe–7 irrigated, subclass VIIe dryland; Loam Upland range site; horticultural group 2; wildlife habitat group 2 irrigated, 11 dryland.

Coolidge-Tremant complex (Cs).—This nearly level mapping unit is on old alluvial fans and valley plains in Rainbow Valley and in the northwestern part of Salt River Valley. Slopes are generally less than 1 percent, but in a few small areas are 2 percent or more. Most areas are long and narrow and about 40 acres in size.

This mapping unit is about 50 percent Coolidge gravelly sandy loam and about 30 percent Tremant gravelly loam. The Tremant soil is in small circular areas that are covered with a varnish desert pavement and are surrounded by Coolidge soils. The Coolidge soil has a profile similar to the one described as representative of the series, but the surface layer is gravelly sandy loam 6 to 12 inches thick.

Included with this unit in mapping are small areas of Laveen loam, 0 to 1 percent slopes; Perryville gravelly loam, 0 to 1 percent slopes; Antho sandy loam, 0 to 1 percent slopes; and Rillito loam, 0 to 1 percent slopes. Also included are a few areas of Tremant soils that are slightly saline in the lower part. Included soils make up about 20 percent of unit.

This mapping unit provides grazing, recreational sites, and wildlife habitat. It is not cultivated, but several areas have been cleared and cultivated. Capability unit IIs–6 irrigated, subclass VIIs dryland; Loam Upland range site; horticultural group 2; wildlife habitat group 2 irrigated, 11 dryland.

Coolidge-Laveen association, 0 to 3 percent slopes (CV).—This nearly level to gently sloping mapping unit is on old alluvial fans in Rainbow Valley and in the area north of Buckeye. It is about ½ mile to 4 miles from granitic, granite-gneiss, and quartzitic mountains. It is dissected by stream channels at 50- to 300-foot intervals. Slopes are generally less than 1 percent, but a few short slopes are more than 2 percent. Areas range from 100 to 1,000 acres in size and are somewhat pear shaped.

This mapping unit is about 40 percent Coolidge sandy loam and 40 percent Laveen sandy loam. The Laveen soil has a profile similar to the one described as representative of the series, but the surface layer is sandy loam. The Coolidge soil is on the upper part of alluvial fans, and the Laveen soil is on the lower part.

Included with this unit in mapping are small areas of Antho sandy loam, 0 to 1 percent slopes; Perryville gravelly loam, 0 to 1 percent slopes; and Rillito loam, 0 to 1 percent slopes. Included soils make up about 20 percent of the unit.

This mapping unit is grazed. None of the acreage is cultivated. Coolidge soil in capability subclass VIIs dryland, Laveen soil in subclass VIIc dryland. Both soils in Loam Upland range site; horticultural group 2; wildlife habitat group 11 dryland.

Dune Land

Dune land (Dn) consists of ridges of very fine, fine, and medium sand that is drifted and deposited by wind. The dunes are 4 to 30 feet high, 100 to 500 feet wide, and ⅛ to ½ mile long. They are oriented to the north or northeast. In most places they are fairly stable and support some vegetation. The sand is dominantly light brown or pale brown and noncalcareous to weakly calcareous. Older material that is strongly calcareous and very strongly alkaline underlies the dunes.

Dune land is in the Harquahala Valley and in an area near Wintersburg. It provides grazing and wildlife habitat. Capability subclass VIIs dryland; Loam Upland range site; horticultural group 4; wildlife habitat group 12 dryland.

Ebon Series

The Ebon series consists of deep, well-drained soils. These soils formed on old alluvial fans that radiate out from the base of the White Tank, Salt River, and Estrella Mountains. The underlying material is very gravelly alluvium derived from granite and granite-gneiss. Slopes range from 0 to 10 percent. Elevations are 1,100 to 1,400 feet. In areas not cultivated the vegetation is bursage, creosotebush, ocotillo, cholla cactus, and scattered mesquite, paloverde, and ironwood trees. The average annual rainfall is 6 to 8 inches, the mean annual air temperature is 69° to 73° F, and the frost-free season is 260 to 300 days.

In a representative profile the surface layer is brown gravelly loam about 2 inches thick. The subsoil extends to a depth of 60 inches. The upper 11 inches is reddish-brown very cobbly clay loam, the next 25 inches is yellowish-red and reddish-brown very cobbly clay, and the lower 22 inches is light reddish-brown very cobbly sandy clay loam. The lower part contains a few filaments and soft spots of lime. The soil is moderately alkaline throughout. It is noneffervescent in the upper 23 inches.

Permeability is slow. Runoff is medium, and the erosion hazard is slight to moderate. The available water capacity is 4 to 6 inches. Roots penetrate to a depth of 60 inches or more.

Ebon soils are used mainly for recreation, wildlife, and range. They are not cultivated. A few areas are used as homesites.

Representative profile of Ebon gravelly loam, 0 to 8 percent slopes, 2,300 feet south and 1,450 feet west of northeast corner of sec. 31, T. 3 N., R. 2 W. in an uncultivated area at the base of the White Tank Mountains:

A1—0 to 2 inches, brown (7.5YR 5/4) gravelly loam, reddish brown (5YR 4/4) when moist; weak, thick, platy structure; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet;

common fine roots; few fine tubular, few very fine and common fine interstitial pores; 20 percent gravel; noneffervescent; moderately alkaline; abrupt, smooth boundary.

B1—2 to 13 inches, reddish-brown (5YR 4/4) very cobbly clay loam, yellowish red (5YR 4/6) when moist; moderate, fine and medium, subangular blocky structure; hard when dry, friable when moist, sticky and plastic when wet; common very fine, fine, and medium roots; few fine tubular and common fine interstitial pores; 60 percent gravel and cobbles; many pressure faces on peds; noneffervescent; moderately alkaline; clear, irregular boundary.

B21t—13 to 23 inches, yellowish-red (5YR 4/6) very cobbly clay, yellowish red (5YR 4/8) when moist; moderate, fine and medium, subangular blocky structure; very hard when dry, firm when moist, sticky and plastic when wet; common very fine and fine roots; few fine tubular and common fine interstitial pores; few thin clay films on peds; 60 percent rounded gravel and cobbles; many pressure faces on peds; noneffervescent; moderately alkaline; clear, wavy boundary.

B22tca—23 to 38 inches, reddish-brown (5YR 5/4) very cobbly clay, yellowish red (5YR 4/8) when moist; weak, fine, subangular blocky structure; hard when dry, friable when moist, sticky and plastic when wet; few very fine and fine roots; few fine tubular and common fine interstitial pores; few thin clay films on peds; 60 percent coarse gravel and cobbles; common black (10YR 2/1) stains on faces of peds; slightly effervescent; few, fine, pinkish-white (7.5YR 8/2), soft lime masses and gravel has thin lime coatings; moderately alkaline; clear, wavy boundary.

B3ca—38 to 60 inches, light reddish-brown (5YR 6/4) very cobbly sandy clay loam, yellowish red (5YR 4/6) when moist; massive; hard when dry, friable when moist, sticky and plastic when wet; common fine tubular and many fine interstitial pores; 70 percent coarse gravel and cobbles; strongly effervescent; few, fine, pinkish-white (7.5YR 8/2) lime filaments and soft lime masses; moderately alkaline.

The solum ranges from 20 to 60 inches or more in thickness. The B horizon ranges from 35 to 80 percent coarse fragments by volume. In most places the solum is noncalcareous, but in some the upper part of the B horizon is weakly to strongly calcareous. The upper 15 inches of the solum is less than 0.9 percent organic matter. The mean annual soil temperature ranges from 72° to 80° F.

The A horizon has hue of 10YR to 5YR, value of 5 or 6 dry and 4 moist, and chroma of 2 to 6. It is weak, thick, and platy or is massive. The B2t horizon has hue of 7.5YR to 2.5YR, but is dominantly 5YR. It has value of 4 to 6 dry and 3 to 5 moist and chroma of 4 to 8. It is 35 to 60 percent clay. The B2t horizon is mainly weak to moderate, medium and fine, subangular blocky, but is moderate prismatic in places. In places the lime accumulation is in the lower part of the Bt horizon or C horizon. In places the soil is more than 15 percent calcium carbonate equivalent.

Ebon gravelly loam, 0 to 8 percent slopes (EbD).—This nearly level to moderately steep soil is on old alluvial fans that extend from the Salt River and Sunnyslope Mountains. It is dissected by numerous intermittent drainageways at 50- to 300-foot intervals. Slopes range from 0 to 8 percent, but some short slopes are as much as 12 percent. Slopes are 400 to 2,000 feet long. The surface area is covered with a varnished desert pavement that is mainly gravel and a few cobbles and stones. Areas are large and fan shaped.

This soil has the profile described as representative of the series. Included in mapping are a few small areas of Pinamt gravelly loam, 0 to 8 percent slopes; Carrizo gravelly sandy loam, 1 to 3 percent slopes; Tremant gravelly loam, 1 to 3 percent slopes; and a few areas of Rock outcrop. Also included are a few small areas of soils that are similar to Ebon soils, but the subsoil and underlying material is less than 35 percent gravel and the underlying material is weakly to strongly cemented below a depth of 30 inches. The total extent of all included soils seldom exceeds 25 percent.

This Ebon soil is used mainly for range (fig. 6), recreation, and wildlife. A few areas are used as homesites. Capability subclass VIIe dryland; Clay Upland range site; horticultural group 3; wildlife habitat group 11 dryland.

Ebon-Pinamt complex, 0 to 10 percent slopes (EPD).—This nearly level to moderately steep mapping unit is on old alluvial fans that form a piedmont slope along the base of the White Tank Mountains. Most fans are 1 mile to 2 miles long. The mapping unit is dissected by intermittent stream channels spaced at 50- to 500-foot intervals that have cut 2 to 30 feet below the surface. Slopes range from 1 to 3 percent, but many short slopes near washes are nearly 10 percent. Areas range from 100 to 500 acres in size.

This mapping unit is about 40 percent an Ebon gravelly loam, 25 percent a Pinamt gravelly sandy loam, and 20 percent a Tremant gravelly loam. These soils have profiles similar to the ones described as representative of their respective series, but the Pinamt soil has a surface layer of gravelly sandy loam and the Tremant soil has a surface layer of gravelly loam. The Ebon soil is in the highest positions nearest the mountains and along the edge of intermittent stream channels. About 60 to 90 percent of the surface area is covered with granite-gneiss gravel and cobbles. The Pinamt soil is at the lower ends of alluvial fans. About 30 to 80 percent of the surface area is covered with granite-gneiss gravel and cobbles. The Tremant soil is in the center of alluvial fans. About 25 to 45 percent of the surface area is covered with granite-gneiss gravel and cobbles.

Included with this unit in mapping are small areas of Gunsight gravelly loam, 1 to 3 percent slopes; Carrizo gravelly sandy loam, 1 to 3 percent slopes; Rillito loam, 1 to 3 percent slopes; and Antho sandy loam, 1 to 3 percent slopes. Also included are a few small areas of soils that are similar to Ebon soils, but they have an indurated lime hardpan at a moderate depth. Included soils make up about 15 percent of this mapping unit.

This mapping unit is used mainly for grazing. It is not cultivated. Capability subclass VIIe dryland. Ebon soil in Clay Upland range site; horticultural group 3; wildlife habitat group 11 dryland. Pinamt soil in Clay Upland range site; horticultural group 2; wildlife habitat group 11.

Estrella Series

The Estrella series consists of deep, well-drained soils on broad alluvial fans and low terraces. These soils formed in medium-textured recent alluvium underlain by older alluvium from a wide mixture of rocks, including acid and basic igneous and some material from shale and limestone. Slopes are less than 1 percent. Elevations are 800 to 1,400 feet. In areas not cultivated the vegetation is creosotebush, cactus, annual weeds and grasses, and scattered mesquite and paloverde trees. Precipitation is 6 to 8 inches, the mean annual air temperature is 69° to 73° F, and the frost-free season is 250 to 300 days.

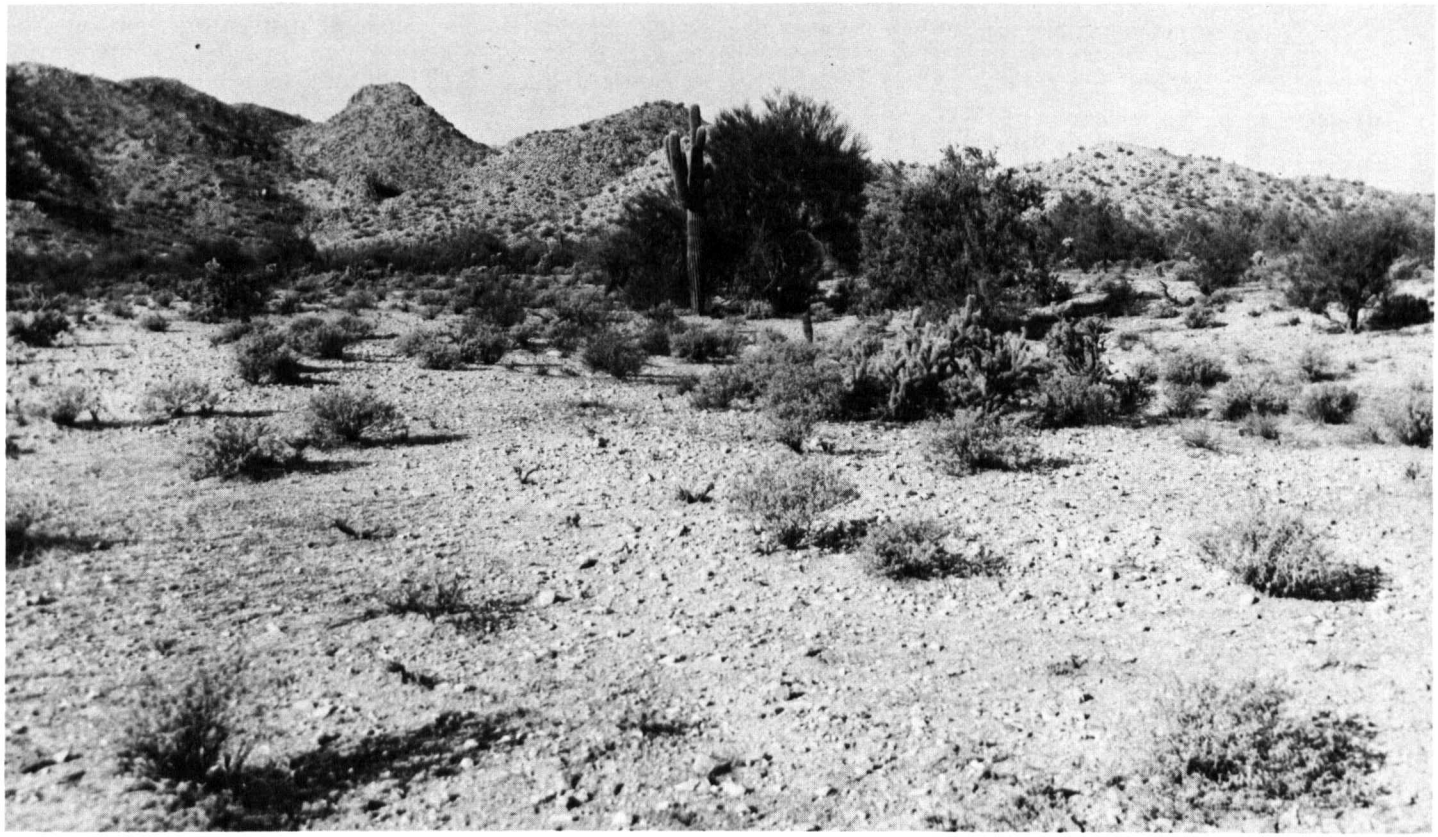

Figure 6.—**Clay Upland range site in poor condition on Ebon gravelly loam.**

In a representative profile the soil is brown and light-brown loam to a depth of about 24 inches. Below this, to a depth of 48 inches, is an older, buried soil that is brown and reddish-yellow clay loam. The underlying material is mottled light-brown gravelly clay loam to a depth of 60 inches. The lower part of the older soil and the underlying material contain a large concentration of lime and a few pebbles. The soil is generally moderately alkaline throughout, but in some areas the lower part is strongly alkaline to very strongly alkaline.

Permeability is moderately slow. Runoff is slow, and the erosion hazard is slight. The available water capacity is 10 to 12 inches. Roots penetrate to a depth of 60 inches.

Estrella soils are used for cotton, alfalfa, barley, sorghum, sugar beets, safflower, wheat, grapes, citrus, and truck crops and for range, wildlife, and recreation. Extensive parts of the cities of Phoenix and Glendale are on these soils.

Representative profile of Estrella loam, 45 feet west and 540 feet north of southeast corner of SW¼ sec. 16, T. 3 N., R. 1 W. in a cultivated field north of Luke Air Force Base:

Ap—0 to 11 inches, brown (10YR 5/3) loam, dark brown (7.5YR 4/4) when moist; massive; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; few fine roots; few fine tubular pores; slightly effervescent; moderately alkaline; abrupt, smooth boundary.

C1—11 to 24 inches, light-brown (7.5YR 6/4) loam, dark brown (7.5YR 4/4) when moist; massive; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; common medium tubular pores; strongly effervescent; few fine filaments of lime in lower part; moderately alkaline; abrupt, smooth boundary.

IIB21tcab—24 to 35 inches, brown (7.5YR 5/4) clay loam, reddish brown (5YR 4/4) when moist; moderate, fine and medium, subangular blocky structure; very hard when dry, friable when moist, sticky and plastic when wet; many fine tubular pores; many thin clay films on faces of peds and lining pores; strongly effervescent; many, fine and medium, distinct, pink (7.5YR 8/4) filaments of lime; moderately alkaline; gradual, smooth boundary.

IIB22tcab—35 to 48 inches, yellowish-red (5YR 4/6) clay loam, reddish brown (5YR 4/4) when moist; moderate, fine and medium, subangular blocky structure; very hard when dry, friable when moist, sticky and plastic when wet; many fine and very fine tubular pores; many thin clay films on faces of peds and lining pores; strongly effervescent; few soft lime nodules; common, fine and medium, distinct, pinkish-gray (5YR 7/2), irregularly shaped filaments of lime; moderately alkaline; abrupt, wavy boundary.

IIC2ca—48 to 60 inches, mottled light-brown (7.5YR 6/4) gravelly light clay loam, mottled brown (7.5YR 5/4) when moist; massive; hard when dry, friable when moist, slightly sticky and plastic when wet; many fine and medium tubular pores; violently to strongly effervescent; many, medium, pink (7.5YR 8/4) patches and filaments of lime; moderately alkaline.

Depth to the buried B2t horizon ranges from 20 to 39 inches, but is commonly 24 to 30 inches. The soil is generally moderately alkaline, but in a few places the buried B2t horizon is strongly alkaline to very strongly alkaline.

The A and C horizons have hue of 7.5YR and 10YR and value of 5 to 7 dry and 3 to 5 moist. These horizons are loam and very fine sandy loam and have a few fine strata of slightly coarser textured material. The lower part of the C horizon

commonly contains a few fine segregations and filaments of lime. In about 40 percent of the areas, this soil has a 1- to 4-inch layer of loamy sand, sandy loam, or gravelly sandy loam at the boundary of the C1 and IIB21tcab horizons. The IIB2tcab horizon has hue of 7.5YR and 5YR, value of 5 or 6 dry and 3 to 5 moist, and chroma of 3 to 6 dry and moist. It is clay loam or sandy clay loam. The IIC horizon ranges from 0 to 15 percent coarse fragments.

Estrella loam (Es).—This nearly level soil is on valley plains and at the lower ends of alluvial fans. Slopes are less than 1 percent. In areas not cultivated the surface is dissected by shallow stream channels spaced at 100- to 500-foot intervals. Areas range from 10 to 500 acres in size.

This soil has the profile described as representative of the series. Included in mapping are small areas of Gilman loam, 0 to 1 percent slopes; Valencia sandy loam; Mohall loam; and Laveen loam, 0 to 1 percent slopes. The total extent of all included soils seldom exceeds 15 percent.

This Estrella soil is mainly used for cotton, alfalfa, sorghum, sugar beets, barley, wheat, safflower, grapes, citrus, and truck crops. Extensive parts of the cities Phoenix and Glendale are on this soil. Some areas are used for range. Capability unit I–1 irrigated, subclass VIIc dryland; Loam Upland range site; horticultural group 1; wildlife habitat group 1 irrigated, 11 dryland.

Estrella loam, saline-alkali (Et).—This smooth, nearly level soil is on valley plains and at the lower ends of alluvial fans in the Harquahala and Rainbow Valleys. Slopes are less than 1 percent. In areas not cultivated the surface is dissected by shallow stream channels spaced at 100- to 500-foot intervals. Areas are about 15 acres in size.

This soil has a profile similar to the one described as representative of the series, but the lower part is strongly alkaline to very strongly alkaline and is slightly saline to strongly saline. Included in mapping are small areas of Casa Grande loam; Laveen loam, saline-alkali; and Gilman loam, saline-alkali. The total extent of all included soils does not exceed 20 percent.

This soil is used mainly for cotton, alfalfa, safflower, barley, sugar beets, and sorghum. It is also used for range. Capability unit IIs–9 irrigated, subclass VIIs dryland; Saline Upland range site; horticultural group 5; wildlife habitat group 1 irrigated, 11 dryland.

Gachado Series

The Gachado series consists of well-drained soils on the lower slopes of mountains and on low hills. These soils are only 14 inches deep over bedrock. They formed in material derived from granite-gneiss, andesite, granite, and basalt. Slopes range from 5 to 10 percent. Elevations are 800 to 1,500 feet. The native vegetation is creosotebush, bursage, paloverde, saguaro, and staghorn cholla cactus. The average annual rainfall is 6 to 8 inches, the mean annual air temperature is 69° to 74° F, and the frost-free season is 250 to 310 days.

In a representative profile the surface layer is light-brown very gravelly clay loam about 1 inch thick. The subsoil is yellowish-red and red very gravelly sandy clay loam and very gravelly loam about 13 inches thick. Bedrock is at a depth of about 14 inches. The soil is slightly effervescent and is moderately alkaline throughout.

Permeability is slow above the bedrock. Runoff is medium, and the erosion hazard is moderate. The available water capacity is 1 to 2 inches. Roots penetrate to a depth of about 14 inches.

Gachado soils are used mainly as range. They are not cultivated. A few areas are used as homesites.

Representative profile of Gachado very gravelly clay loam in an area of Gachado-Rock outcrop complex, 3,770 feet east and 2,640 feet north of southwest corner of sec. 27, T. 1 S., R. 2 W.:

A1—0 to 1 inch, light-brown (7.5YR 6/4) very gravelly clay loam, reddish brown (5YR 4/4) when moist; weak, thick, platy sturcture; slightly hard when dry, very friable when moist, sticky and plastic when wet; few fine roots; common fine vesicular pores; 60 percent fine and medium subangular gravel; slightly effervescent; moderately alkaline; abrupt, smooth boundary.

B1—1 to 3 inches, yellowish-red (5YR 5/6) very gravelly loam, yellowish red (5YR 4/6) when moist; massive; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; few fine roots; common fine interstitial pores; 50 percent fine and medium subangular gravel; slightly effervescent; moderately alkaline; abrupt, wavy boundary.

B21—3 to 4 inches, red (2.5YR 5/6) very gravelly loam, red (2.5YR 4/6) when moist; weak, fine, subangular blocky structure; slightly hard when dry, friable when when moist, slightly sticky and slightly plastic when wet; very few fine roots; common fine interstitial pores; 60 percent fine, medium, and coarse subangular gravel; slightly effervescent; few fine and many large pinkish-white (7.5YR 8/2) filaments of lime; moderately alkaline; abrupt, wavy boundary.

B22t—4 to 10 inches, yellowish-red (5YR 5/6) very gravelly sandy clay loam, yellowish red (5YR 4/6) when moist; weak, fine, subangular blocky structure; hard when dry, friable when moist, sticky and plastic when wet; few fine roots; few fine tubular and common fine intersitial pores; few thin clay films on faces of peds; 50 percent fine subangular and medium gravel; slightly effervescent; common, fine, pinkish-white (7.5YR 8/2) filaments of lime; moderately alkaline; clear, smooth boundary.

B3ca—10 to 14 inches, yellowish-red (5YR 5/6) very gravelly sandy clay loam, reddish brown (5 YR 4/4) when moist; massive; slightly hard when dry, friable when moist, sticky, very plastic when wet; few fine roots; many fine interstitial pores; 60 percent fine and medium subangular gravel; slightly effervescent; common, fine, pinkish-white (7.5YR 8/2) filaments of lime; moderately alkaline; abrupt, wavy boundary.

R—14 inches, white (10YR 8/0) fractured granite-gneiss and ⅛ to ½ inch thick white lime coatings on top; extremely hard; bedrock is noneffervescent, coating violently effervescent.

Thickness of the solum and depth to bedrock range from 10 to 20 inches. The solum is commonly more than 35 percent rock fragments, but some thin horizons are less than 35 percent. The pH ranges from 7.9 to 8.4. The A1 horizon has hue of 7.5YR and 5YR, value of 5 or 6 dry and 3 or 4 moist, and chroma of 3 or 4 dry and moist. It is very gravelly or cobbly loam and very gravelly or cobbly clay loam. The B horizon has hue of 7.5 YR and 5 YR, value of 4 or 5 dry and 3 or 4 moist, and chroma of 4 to 6 dry and moist. Some profiles have a thin Cca horizon and no B3ca horizon. Lime accumulation ranges from a few filaments of lime to a thin petrocalcic horizon just above bedrock.

Gachado-Rock outcrop complex (GA).—This moderately steep mapping unit is on lower slopes of low hills and mountains in the Rainbow and Harquahala Valleys. Slopes generally range from 5 to 10 percent, but in a few areas are more than 10 percent. The surface area is dissected by shallow stream channels spaced at 40- to 200-foot intervals. These channels have cut 1 foot to 3 feet below the surface.

This mapping unit is about 40 percent Gachado very gravelly clay loam and about 40 percent Rock outcrop. Rock outcrop is in random, circular areas about 20 to 100 feet in diameter. It is surrounded by the Gachado soil.

Included with this unit in mapping are areas of Cherioni very gravelly loam and a few small areas of Rillito, Pinal, and Gunsight soils. These soils make up about 20 percent of this mapping unit.

This mapping unit is used for range and wildlife. Capability subclass VIIe dryland. Gachado soil in Loam Hills range site; horticultural group 7; wildlife habitat group 12 dryland.

Gadsden Series

The Gadsden series consists of deep, well-drained soils. These soils formed in recent alluvium derived from a wide mixture of rocks that were deposited on flood plains and low terraces along the Gila and Salt Rivers. Slopes are less than 1 percent. Elevations are 750 to 1,150 feet. In areas not irrigated the vegetation is creosotebush, catclaw, fourwing saltbush, arrowweed, Mormon-tea, annual weeds and grasses, and scattered mesquite and tamarix trees. The average annual rainfall is about 6 to 8 inches, the mean annual air temperature is 69° to 73° F, and the frost-free season is 250 to 300 days.

In a representative profile the soil is brown clay to a depth of about 43 inches and brown clay loam to a depth of 60 inches. The soil is moderately alkaline throughout. It is strongly effervescent to a depth of 43 inches. In a few areas the surface layer is clay loam. In some areas the soil contains excessive amounts of saline and alkali salts.

Permeability is slow. Runoff is slow, and the erosion hazard is none to slight. The available water capacity is 9 to 10 inches. Roots penetrate to a depth of 60 inches or more.

Gadsden soils are used mainly for irrigated crops, range, recreation, and wildlife. Irrigated crops are cotton, alfalfa, sorghum, barley, and sugar beets. A few areas are used as building sites.

Representative profile of Gadsden clay, 78 feet west and 294 feet north of southeast corner of sec. 16, T. 1 N., R. 2 E. in cultivated field south of Phoenix:

Ap—0 to 10 inches, brown (7.5YR 5/2) clay, dark brown (7.5YR 3/2) when moist; weak, fine, subangular blocky structure; very hard when dry, friable when moist, sticky and plastic when wet; common medium and fine roots; common fine tubular and few fine interstitial pores; strongly effervescent; moderately alkaline; abrupt, smooth boundary.

A1—10 to 29 inches, brown (10YR 4/3) clay, dark brown (7.5YR 3/2) when moist; massive; very hard when dry, friable when moist, sticky and plastic when wet; common fine and very fine roots; few very fine and medium tubular pores; few pressure faces; strongly effervescent; few, fine, pinkish-white (7.5YR 8/2) filaments of lime in the lower part; moderately alkaline; clear, smooth boundary.

C1—29 to 43 inches, brown (7.5YR 5/4) clay, dark brown (7.5YR 3/2) when moist; massive; very hard when dry, friable when moist, sticky and very plastic when wet; common very fine and few fine roots; common fine tubular pores; weak planes of stratification; strongly effervescent; few, fine, pinkish-white (7.5YR 8/2) filaments of lime; moderately alkaline; abrupt, smooth boundary.

C2—43 to 60 inches, brown (7.5YR 5/4) clay loam, brown (7.5YR 4/4) when moist; massive; hard when dry, friable when moist, slightly sticky and plastic when wet; common very fine roots; few fine tubular pores; common black (10YR 2/1) stains; weak planes of stratification; slightly effervescent; moderately alkaline.

These soils are effervescent throughout, but do not have a Cca horizon. They are generally dry, but sometimes in summer they are moist between depths of 10 and 40 inches. When the soil is dry, cracks are one-half inch wide or more at a depth of 20 inches. The soil temperature ranges from 72° to 80° F.

The A and C horizons have hue ranging from 10YR to 7.5YR, value ranging from 6 to 4 dry and 4 or 3 moist, and chroma ranging from 2 to 4 dry and moist. These horizons range from clay loam to clay. The Ap horizon ranges from weak, fine, subangular blocky to weak, medium, granular. A few pressure faces and a few slickensides occur throughout the C horizon. Thin layers of very fine sandy loam, loam, or clay loam are common between depths of 10 and 40 inches. Electrical conductivity ranges from 2 to 15 millimhos per centimeter.

Gadsden clay loam (Gb).—This nearly level soil is on flood plains of the Gila and Salt Rivers. The surface is smooth. Slopes are generally less than 0.5 percent. Areas range from 5 to 75 acres in size.

This soil has a profile similar to the one described as representative of the series, but the surface layer is clay loam 10 to 14 inches thick. Included in mapping are small areas of Glenbar clay loam; Cashion clay, saline-alkali; and Avondale clay loam and areas of other Gadsden soils that have a surface layer of loam.

This Gadsden soil is used mainly for irrigated crops, range, recreation, and wildlife. Irrigated crops are cotton, alfalfa, barley, sorghums, and sugar beets. A few areas are used as building sites. Capability unit IIIs–8 irrigated, subclass VIIs dryland; Sandy Bottom range site; horticultural group 3; wildlife habitat group 3 irrigated, 9 dryland.

Gadsden clay (Gc).—This nearly level soil is on flood plains and low terraces along the Gila and Salt Rivers. The surface is generally smooth and slightly concave. When it is dry, cracks ranging from ½ inch to 2 inches wide often extend to a depth of 20 inches or more. Slopes are less than 0.5 percent. Areas range from 2 to 300 acres in size, but are generally less than 100 acres.

This soil has the profile described as representative of the series. Included in mapping are small areas of Glenbar clay; Glenbar clay loam; Cashion clay, saline-alkali; Avondale clay loam; and a few areas of Gadsden clay loam. Also included is a large area of soils south of the town of Cashion where the surface layer is lighter colored and a few thin lenses weakly cemented with lime and silica are below a depth of 30 inches. The total extent of all included soils is less than 20 percent.

This Gadsden soil is used mainly for irrigated crops, range, recreation, and wildlife. Irrigated crops are cotton, alfalfa, barley, sorghum, and sugar beets. A few areas are used as building sites. Capability unit IIIs–3 irrigated, subclass VIIs dryland; Sandy Bottom range site; horticultural group 3; wildlife habitat group 3 irrigated, 9 dryland.

Gadsden clay, saline-alkali (Gd).—This nearly level soil is on flood plains and low stream terraces along the Gila and Salt Rivers. It is most extensive in the vicinity of Arlington and Buckeye. The surface is generally smooth and slightly concave. Slopes are less than 0.5 percent.

Areas are generally long and narrow and about 30 acres in size.

This soil has a profile similar to the one described as representative of the series, but it contains large amounts of salts and alkali. In areas not cultivated the surface area is often covered with a white crust of salt. When it is dry, cracks ranging from ½ inch to 1 inch wide extend to a depth of 6 to 12 inches.

Included with this soil in mapping are small areas of Glenbar clay loam; Cashion clay, saline-alkali; Avondale clay loam; and Gadsden clay. The total extent of all included soils seldom exceeds 15 percent.

This Gadsden soil is used for irrigated crops, recreation, wildlife, and range. Irrigated crops are cotton, alfalfa, sugar beets, sorghum, and barley. Capability unit IVs–9 irrigated, subclass VIIs dryland; Sandy Bottom range site; horticultural group 3; wildlife habitat group 8 irrigated, 11 dryland.

Gilman Series

The Gilman series consists of deep, well-drained soils on valley plains and low stream terraces. These soils formed in recent alluvium derived from a wide mixture of rocks, including andesite, basalt, schist, rhyolite, and granite-gneiss. Slopes are 0 to 3 percent. Elevations are 800 to 1,400 feet. In areas not cultivated, the vegetation is creosotebush, cactus, annual weeds and grasses, and a few mesquite and paloverde trees. The precipitation is 6 to 8 inches, the mean annual air temperature is 60° to 73° F, and the frost-free season is 250 to 300 days.

In a representative profile the surface layer is yellowish-brown loam about 5 inches thick. The underlying material is light yellowish-brown loam and very fine sandy loam to a depth of 64 inches. The soil is moderately alkaline throughout and is weakly effervescent to strongly effervescent.

Permeability is moderate. Runoff is slow, and the erosion hazard is slight to moderate. The available water capacity is 10 to 11 inches. Some areas of soils are affected by saline and alkali salts. Roots penetrate to a depth of 60 inches or more. In a few areas the soils are subject to flooding for a period of about 5 hours once in 10 years.

Gilman soils are used for irrigated crops, range, recreation, wildlife, and for homesites and industrial sites and parks. Irrigated crops are cotton, alfalfa, sorghum, barley, safflower, sugar beets, citrus, grapes, and vegetables.

Representative profile of Gilman loam, 0 to 1 percent slopes, 63 feet west and 213 feet south of the northeast corner of NE¼SW¼ sec. 18, T. 2 N., R. 1 W. in a cultivated area southwest of Luke Air Force Base:

Ap—0 to 5 inches, yellowish-brown (10YR 5/4) loam, dark brown (7.5YR 4/4) when moist; massive; slightly hard when dry, friable when moist, sticky and plastic when wet; common fine roots; many fine interstitial pores; strongly effervescent; moderately alkaline; abrupt, smooth boundary.

C1—5 to 18 inches, light yellowish-brown (10YR 6/4) loam, dark brown (7.5YR 4/4) when moist; massive; hard when dry, friable when moist, sticky and plastic when wet; few medium and common fine roots; few fine and medium and many very fine tubular pores; strongly effervescent; few, fine, faint, white (10YR 8/2) filaments of lime; moderately alkaline; clear, smooth boundary.

C2—18 to 27 inches, light yellowish-brown (10YR 6/4) loam, dark yellowish-brown (10YR 4/4) when moist; massive; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; many fine roots; many fine and very fine and few medium tubular pores; strongly effervescent; few, fine, faint, pinkish-white (7.5YR 8/2) filaments of lime; moderately alkaline; gradual, smooth boundary.

C3—27 to 37 inches, light yellowish-brown (10YR 6/4) loam, dark brown (10YR 4/3) when moist; massive; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; common fine roots; few fine and very fine tubular pores; slightly effervescent; moderately alkaline; gradual, smooth boundary.

C4—37 to 51 inches, light yellowish-brown (10YR 6/4) very fine sandy loam, dark brown (10YR 4/3) when moist; massive; slightly hard when dry, very friable when moist, slightly sticky and nonplastic when wet; common fine and medium and few coarse roots; many fine interstitial pores; strongly effervescent; moderately alkaline; gradual, smooth boundary.

C5—51 to 64 inches, light yellowish-brown (10YR 6/4) very fine sandy loam, dark yellowish-brown (10YR 4/4) when moist; massive; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; common medium and coarse roots; few very fine tubular pores; strongly effervescent; moderately alkaline.

The A and C horizons have hue of 7.5YR and 10YR, value of 4 to 6 dry and 3 to 5 moist, and chroma of 2 to 4 dry and moist. The Ap horizon is loam, fine sandy loam, or very fine sandy loam. The C horizon is very fine sandy loam or loam. Thin layers of finer textured or coarser textured material are common throughout the C horizon. In most places the soil is micaceous and filaments of lime in the C horizon range from none to common. In some places the soil contains a few rounded pebbles. The pH value generally ranges from 8.0 to 8.4, but ranges from 8.5 to 9.0 in places.

Gilman fine sandy loam (Ge).—This level to nearly level soil is on flood plains, alluvial fans, and low terraces. It occurs throughout the survey area. In areas not cultivated, it is somewhat hummocky. Slopes are dominantly less than 0.5 percent. Areas range from 2 to 900 acres in size, but are generally less than 100 acres.

This soil has a profile similar to the one described as representative of the series, but the surface layer is fine sandy loam 8 to 14 inches thick in most places and is sandy loam in some.

Included with this soil in mapping are small areas of Antho sandy loam, 0 to 1 percent slopes; Agualt loam; Vint fine sandy loam; Estrella loam; Valencia sandy loam; and Laveen sandy loam. Also included are areas of soils that are gravelly in the lower part. The total extent of all included soils seldom exceeds 20 percent.

This Gilman soil is used mainly for cotton, alfalfa, barley, safflower, sorghum, citrus, grapes, sugar beets, and vegetables. Several areas are in the cities of Phoenix and Glendale. Some areas are used for range. Capability unit I–2 irrigated, subclass VIIc dryland; Loam Upland range site; horticultural group 1; wildlife habitat group 1 irrigated, 11 dryland.

Gilman fine sandy loam, saline-alkali (Gf).—This nearly level soil is at the lower ends of alluvial fans and on low stream terraces along the Gila and Salt Rivers. In some areas not cultivated, low mounds as much as 2 feet high surround the brush. A white crust of salt covers the surface area in places. Slopes are mostly less than 0.5 percent. Areas are 10 to 40 acres in size.

This soil has a profile similar to the one described as representative of the series, but the surface layer is fine sandy loam 8 to 14 inches thick and is strongly affected

with saline and alkali salts. Also, in a few areas along the Arlington Canal, the water table is at a depth of 2 to 5 feet. In some areas several thin strata of sand are in the lower part.

Included with this soil in mapping are small areas of Vint fine sandy loam; Antho sandy loam, 0 to 1 percent slopes; Avondale clay loam, saline-alkali; and Maripo sandy loam. The total extent of all included soils seldom is more than 20 percent.

This soil is used for range. It is seldom cultivated. A few areas are used for cotton, safflower, barley, alfalfa, or pasture. Capability unit IIs–9 irrigated, subclass VIIs dryland; Saline Upland range site; horticultural group 5; wildlife habitat group 1 irrigated, 11 dryland.

Gilman loam, 0 to 1 percent slopes (GgA).—This nearly level soil is on stream terraces, valley plains, and alluvial fans. It occurs throughout the survey area. Areas are generally long and narrow and are parallel to stream channels. They are about 30 acres in size.

This soil has the profile described as representative of the series. Included in mapping are small areas of Agualt loam; Antho sandy loam, 0 to 1 percent slopes; Estrella loam; Glenbar loam; and Laveen loam, 0 to 1 percent slopes. The total extent of all included soils seldom exceeds 20 percent.

This Gilman soil is used mainly for cotton, alfalfa, barley, sorghum, safflower, sugar beets, grapes, citrus, and vegetables. In areas not cultivated, it is used as range. Extensive areas of the cities of Phoenix and Glendale are on this soil. Capability unit I–1 irrigated, subclass VIIc dryland; Loam Upland range site; horticultural group 1; wildlife habitat group 1 irrigated, 11 dryland.

Gilman loam, 1 to 3 percent slopes (GgB).—This gently sloping soil is on alluvial fans and stream terraces. Slopes are generally about 1.5 percent, but a few short slopes are nearly 3 percent. The erosion hazard is moderate. Areas are convex, long, narrow strips about 50 acres in size.

Included with this soil in mapping are small areas of Antho sandy loam, 1 to 3 percent slopes; Gilman loam, saline-alkali; and Laveen loam, 1 to 3 percent slopes. The total extent of all included soils seldom exceeds 20 percent.

This Gilman soil is used mainly for range. Irrigated areas are used for cotton, alfalfa, and barley. Capability unit IIe–1 irrigated, subclass VIIe dryland; Loam Upland range site; horticultural group 1; wildlife habitat group 1 irrigated, 11 dryland.

Gilman loam, saline-alkali (Gh).—This nearly level soil is on flood plains and low terraces along the Gila and Salt Rivers, Centennial Wash, and small streams near Wintersburg. In some areas not cultivated, it is hummocky and in other areas it is dissected by V-shaped gullies, 1 foot to 4 feet deep, spaced at 10- to 200-foot intervals. In areas between gullies the surface is frequently slicked over or has a white salt crust. Areas are long and narrow and about 100 acres in size. A few are flooded for a period of about 5 hours once every 10 years.

This soil has a profile similar to the one described as representative of the series, but is affected by saline and alkali salts.

Included with this soil in mapping are small areas of Laveen loam, saline-alkali; Antho sandy loam, saline-alkali; Estrella loam, saline-alkali; and Avondale clay loam, saline-alkali. The total extent of all included soils seldom exceeds 15 percent.

This Gilman soil is used mainly for range. Irrigated areas are used for cotton, alfalfa, barley, sugar beets, sorghum, and safflower. Capability unit IIs–9 irrigated, subclass VIIs dryland; Saline Upland range site; horticultural group 5; wildlife habitat group 1 irrigated, 11 dryland.

Gilman complex, saline-alkali (GL).—This mapping unit is on flood plains of Centennial Wash in Harquahala Valley. In some places the surface area is smooth, and in areas near drainageways it is hummocky. The hummocks range from 1 foot to 20 feet in height and are about 1 acre in size. Near the hummock are small blowouts that are 2 to 10 feet deep. Numerous gullies dissect the surface and are entrenched 1 to 6 feet. Slopes range from less than 1 percent to 3 percent.

This mapping unit is about 40 percent Gilman loam, saline-alkali, and about 40 percent other Gilman soils that are moderately deep over stratified fine sandy loam, loam, clay loam, and gravelly equivalents. These sediments are highly mottled and have many dark stains. Gilman loam, saline-alkali, has a smooth surface.

Included with this unit in mapping are areas of Antho sandy loam, saline-alkali, and areas of a severely eroded soil that has stratified sediment at or near the surface. Each of these soils makes up about 5 percent of the unit. Also included are small areas of Estrella loam, Carrizo gravelly sandy loam, Maripo sandy loam, and Harqua gravelly clay loam, all of which make up no more than 10 percent of the unit.

This mapping unit provides grazing. It is not cultivated. Capability subclass VIIs dryland; Saline Upland range site; horticultural group 5; wildlife habitat group 11 dryland.

Gilman-Antho association (GM).—This nearly level mapping unit is on valley plains and in or near major stream channels. Slopes are generally less than 1 percent, but a few short slopes are nearly 3 percent. Areas are long and narrow and about 200 acres in size.

This mapping unit is about 50 percent a Gilman loam and a Gilman fine sandy loam, 15 percent an Antho sandy loam, 10 percent an Antho gravelly sandy loam, and 10 percent Agualt loam. The Gilman fine sandy loam soil has a profile similar to the one described as representative of the series, but the surface soil is fine sandy loam 6 to 12 inches thick. The Antho gravelly sandy loam has a profile similar to the one described as representative of the series, but it is 15 to 30 percent gravel throughout. The Gilman soils have a smooth surface. The Antho soils are on long, narrow, slightly convex ridges throughout the mapping unit. The Agualt soil is along margins of intermittent stream channels.

Included with this unit in mapping are small areas of Laveen loam, 0 to 1 percent slopes; Maripo sandy loam; Estrella loam; and Carrizo gravelly sandy loam. Included soils make up about 15 percent of the unit.

This mapping unit is not cultivated. It is used for range. A few areas near Beardsley are used as homesites. Gilman soils in capability subclass VIIc dryland; Loam Upland range site; horticultural group 1; wildlife habitat group 11 dryland. Antho soils in capability subclass VIIs dryland; Loam Upland range site; horticultural group 1; wildlife habitat group 11 dryland.

Gilman-Laveen association (GN).—This mapping unit is in slightly concave areas on valley plains and broad alluvial fans. It is dissected by shallow stream channels

spaced at about 300- to 500-foot intervals. Slopes are generally less than 1 percent. Areas are pear shaped and about 400 acres in size.

This mapping unit is about 45 percent Gilman loam, 0 to 1 percent slopes, and 30 percent Laveen loam, 0 to 1 percent slopes. The Gilman soil is in concave positions that are slightly lower than the Laveen soil.

Included with this unit in mapping are areas of Estrella loam that are in intermediate positions between the Gilman and Laveen soils. This included soil makes up as much as 20 percent of the unit. Also included are small areas of Mohall loam, Tremant loam, Coolidge sandy loam, and Agualt loam. The total extent of all included soils is 25 percent.

This mapping unit is used for range. It is not cultivated. Capability subclass VIIc dryland. Gilman soil in Loam Upland range site; horticultural group 1; wildlife habitat group 11 dryland. Laveen soil in Loam Upland range site; horticultural group 2; wildlife habitat group 11 dryland.

Gilman, Antho and Glenbar soils, severely eroded (Go3).—This mapping unit is parallel to or near the main stream channels. It is highly dissected by V-shaped gullies, 3 to 25 feet deep, spaced at about 10- to 50-foot intervals. Between gullies the surface area is generally slicked over and devoid of vegetation. Slopes range from 1 to 5 percent.

This mapping unit is about 55 percent Gilman soils, 25 percent Antho soils, and 20 percent Glenbar soils. The percentages of soils vary. The Antho soils and Glenbar soils do not occur in some mapped areas. The soils have profiles similar to the ones described as representative of their respective series, but their surface layer is variable and severely eroded.

These soils are nonarable and are used for grazing. Capability subclass VIIe dryland; Saline Upland range site; horticultural group 5; wildlife habitat group 11 dryland.

Gilman Variant

The Gilman variant consists of deep, well-drained soils underlain by clayey sediment at a depth of 20 to 40 inches. These soils formed in recent alluvium deposited on stream terraces and flood plains. The alluvium was derived from a wide mixture of rock, including andesite, rhyolite, schist, gneiss, basalt, and some shale. Slopes are 0 to 1 percent. Elevations are 750 to 1,000 feet. In areas not cultivated, the vegetation is saltcedar, saltbush, creosotebush, mesquite, and annual weeds and grasses. The precipitation is 6 to 8 inches, the mean annual air temperature is 68° to 72° F, and the frost-free season is 250 to 300 days.

In a representative profile the surface layer is grayish-brown loam about 3 inches thick. The underlying material is light brownish-gray very fine sandy loam to a depth of 28 inches and pinkish-gray silty clay to a depth of 60 inches. The soil is moderately saline, strongly effervescent, and moderately alkaline to strongly alkaline.

Permeability is moderate in the loamy upper part and slow in the lower part. Runoff is slow, and the erosion hazard is slight. The available water capacity is 9 to 10 inches. Roots penetrate to a depth of 60 inches or more. A few areas of these soils are subject to flooding for a period of about 5 hours about once in 10 years.

These Gilman soils are used for irrigated crops, range, recreation, and wildlife. Irrigated crops are cotton, alfalfa, and barley.

Representative profile of Gilman loam, clayey subsoil variant, moderately saline, 100 feet north and 550 feet east of southwest corner of sec. 19, T. 1 S., R. 4 W. in an uncultivated area southwest of Palo Verde:

A1—0 to 3 inches, grayish-brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) when moist; massive; hard when dry, friable when moist, slightly sticky and plastic when wet; few very fine roots; common very fine interstitial and few very fine tubular pores; slightly saline; strongly effervescent; moderately alkaline; abrupt, smooth boundary.

C1—3 to 8 inches, light brownish-gray (10YR 6/2) very fine sandy loam, dark grayish brown (10YR 4/2) when moist; massive; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; common very fine and few medium roots; common very fine interstitial and very fine tubular pores; slightly saline; strongly effervescent; moderately alkaline; clear, smooth boundary.

C2—8 to 28 inches, light brownish-gray (10YR 6/2) very fine sandy loam, dark grayish brown (10YR 4/2) when moist; massive; soft when dry, very friable when moist, slightly sticky and slightly plastic when wet; common fine and very fine roots; common fine and very fine interstitial and few very fine tubular pores; moderately saline; strongly effervescent; moderately alkaline; abrupt, smooth boundary.

IIC3—28 to 60 inches, pinkish-gray (7.5YR 6/2) silty clay, brown (7.5YR 4/2) when moist; massive; very hard when dry, firm when moist; sticky and very plastic when wet; very few fine and very fine tubular pores; moderately saline; common, fine, white (5YR 8/1) filaments of salt; violently effervescent; moderately alkaline.

Depth to the contrasting fine-textured layer ranges from 20 to 39 inches, but is generally 26 to 32 inches. Hue is 7.5YR, 5YR, and 10YR; value is 4 to 6 when dry and 3 to 5 when moist; and chroma is 1 to 4 dry and moist. The A, C, and C2 horizons are loam, very fine sandy loam, and silt loam. Thin strata of fine sandy loam, sandy loam, or clay loam are common. These horizons range from nonsaline to moderately saline. The IIC3 horizon is clay or silty clay. In places it is one continuous layer to a depth of 60 inches. In other places it occurs as several layers separated by thin strata of loam, silt loam, very fine sandy loam, or fine sandy loam. Salinity ranges from slightly saline to very strongly saline.

Gilman loam, clayey subsoil variant, moderately saline (Gp).—This nearly level soil is on flood plains and low stream terraces along the Gila and Salt Rivers. Slopes are less than 1 percent. Areas not level are slightly concave, and in some areas the surface is covered with a thin, white crust of salt. Areas are long and narrow and about 15 acres in size.

Included with this soil in mapping are small areas of Gilman loam, saline-alkali; Avondale clay loam, saline-alkali; and Gadsden clay loam. Included soils do not make up more than 5 percent of this mapping unit.

This Gilman variant is used for irrigated crops, range, recreation, and wildlife. Irrigated crops are cotton, alfalfa, and barley. Capability unit IIIs–9 irrigated, subclass VIIs dryland; Sandy Bottom range site; horticultural group 5; wildlife habitat group 3 irrigated, 13 dryland.

Glenbar Series

The Glenbar series consists of deep, well-drained soils. These soils formed in alluvium derived from a wide variety of rock that was deposited on valley plains and low stream

terraces. Slopes are generally less than 1 percent. Elevations are 700 to 1,250 feet. The climate is arid continental. In areas not cultivated, the vegetation is creosotebush, annual weeds and grasses, and scattered mesquite, tamarix, paloverde, and ironwood trees. The average annual rainfall is about 6 to 8 inches, the mean annual air temperature is about 68° to 71° F, and the frost-free season ranges from 250 to 300 days.

In a representative profile the surface layer is brown clay loam about 15 inches thick. The underlying material is light-brown and pale-brown clay loam and silty clay loam to a depth of 60 inches. The soil is moderately alkaline and is strongly effervescent throughout.

Permeability is moderately slow. Runoff is slow, and the erosion hazard is slight. Roots penetrate to a depth of 60 inches or more.

Glenbar soils are used for irrigated crops, range, recreation, and wildlife. Irrigated crops are cotton, alfalfa, wheat, barley, sorghum, safflower, sugar beets, grapes, citrus, vegetables, and pastures. The soils are also used as material for brick. The town of Tolleson and parts of the cities of Phoenix and Glendale are on these soils.

Representative profile of Glenbar clay loam, 23 feet east of the SW¼SW¼NE¼ sec. 3, T. 1 N., R. 1 E. in a cultivated field about one-half mile northeast of Tolleson:

Ap—0 to 15 inches, brown (10YR 5/3) clay loam, dark brown (10YR 4/3) when moist; weak, fine and medium, subangular blocky structure; hard when dry, friable when moist, sticky and plastic when wet; common very fine and fine roots; few fine tubular pores; strongly effervescent; moderately alkaline; abrupt, smooth boundary.

C1—15 to 27 inches, pale-brown (10YR 6/3) clay loam, dark brown (10YR 4/3) when moist; massive; hard when dry, friable when moist, sticky and plastic when wet; common very fine and fine roots; common very fine and fine tubular pores; common worm casts; strongly effervescent; moderately alkaline; clear, smooth boundary.

C2—27 to 48 inches, light-brown (7.5YR 6/4) silty clay loam, dark brown (7.5YR 4/4) when moist; massive; hard when dry, friable when moist, sticky and plastic when wet; common fine roots; common very fine and fine tubular pores; strongly effervescent; common fine filaments of lime; moderately alkaline; clear, smooth boundary.

C3—48 to 56 inches, pale-brown (10YR 6/3) silty clay loam, dark brown (10YR 4/3) when moist; massive; slightly hard when dry, friable when moist, sticky and plastic when wet; few fine roots; common fine and very fine tubular pores; strongly effervescent; few, fine, faint filaments of lime; moderately alkaline; abrupt, smooth boundary.

C4—56 to 60 inches, light-brown (7.5YR 6/4) clay loam to silty clay loam, dark brown (7.5YR 4/4) when moist; massive; hard when dry, friable when moist, sticky and plastic when wet; few fine roots; common fine tubular pores; strongly effervescent; common, fine, faint filaments of lime; moderately alkaline.

Hue is 10YR and 7.5YR, value is 5 to 7 dry and moist, and chroma is 2 to 4 dry and moist. The A horizon is generally clay loam, but ranges to silty clay loam, loam, or clay. The C horizon is generally clay loam, but ranges to heavy loam or silty clay loam. In places the soil is 50 inches of homogeneous clay loam, and in others it is 26 inches or more of clay loam over loam. In all cases, the soil between depths of 10 and 40 inches averages more than 18 percent but less than 35 percent clay. In most areas the soil is stratified with ½- to 5-millimeter layers of loam, very fine sandy loam, fine sandy loam, and clay. The soil is generally micaceous throughout, and the lower part contains a few filaments of lime. In some areas near the Gila River, the soil is affected by soluble salts.

Glenbar loam (Gr).—This level to nearly level soil is on valley plains and low terraces throughout the survey area. It is smooth. Slopes are generally less than 1 percent. Areas range from 3 to 250 acres in size, but average less than 50 acres.

This soil has a profile similar to the one described as representative of the series, but the surface layer is loam generally 8 to 13 inches thick and as much as 20 inches thick in places. The soil is commonly clay between depths of 10 and 40 inches, but is heavy loam or light clay in some small areas.

Included with this soil in mapping are a few areas of soils where the surface layer is darker colored than the one described as representative, some areas where the surface layer is fine sandy loam, and some areas in the Salt River Valley where the lower part of the soil has a few silica-cemented nodules. Also included are small areas of Gilman loam, 0 to 1 percent slopes; Avondale clay loam; and Gilman loam, clayey subsoil variant. The total extent of all included soils is generally less than 15 percent.

This Glenbar soil holds 11 to 13 inches of water available to plants. It is used for cotton, alfalfa, sugar beets, barley, citrus, and safflower and for range. Capability unit I–1 irrigated, subclass VIIc dryland; Loam Upland range site; horticultural group 1; wildlife habitat group 1 irrigated, 11 dryland.

Glenbar loam, saline-alkali (Gs).—This level to nearly level soil is on flood plains and low terraces in the Harquahala Valley and in the Buckeye area. Slopes are generally less than 1 percent. Areas are smooth and range from 2 to 200 acres in size.

The profile of this soil is similar to the one described as representative of the series, but the surface layer is only 8 to 12 inches thick and the texture ranges from very fine sandy loam to silt loam. It is affected by salts and alkali. In areas not cultivated, the surface is commonly covered with a thin white crust of salt. The soil ranges from slightly saline to strongly saline, but is typically moderately saline.

The available water capacity ranges from 7 to 8 inches. In a few areas near Palo Verde, the water table is within 3 feet of the surface.

Included with this soil in mapping are small areas of Gilman loam, saline-alkali; Estrella loam, saline-alkali; and Gadsden clay loam.

This Glenbar soil is used for irrigated crops, including cotton, alfalfa, barley, and bermudagrass pasture. It is also used for range. Capability unit IIs–9 irrigated, subclass VIIs dryland; Saline Upland range site; horticultural group 5; wildlife habitat group 1 irrigated, 13 dryland.

Glenbar clay loam (Gt).—This nearly level soil is on valley plains and alluvial terraces parallel to but ¼ to 1 mile from the Gila, Salt, and Agua Fria Rivers. Slopes are less than 1 percent. Areas are smooth and oblong in shape. They range from 5 to 2,000 acres in size, but are mostly about 70 acres in size.

This soil has the profile described as representative of the series. Included in mapping are small areas of Avondale clay loam; Gilman loam, 0 to 1 percent slopes; Trix clay loam; and Gadsden clay loam; and a few areas of soils that are affected by salts. Also included are a few areas of soils underlain by sand below a depth of 40 inches and some areas where the surface layer is darker

colored than the one described in the representative profile.

This Glenbar soil holds 11 to 13 inches of water available to plants. It is used for irrigated crops, range, recreation, and wildlife. Irrigated crops are cotton, alfalfa, wheat, barley, sorghum, safflower, sugar beets, citrus, grapes, and vegetables. Also, the soil is used as material for bricks. The town of Tolleson and parts of the cities of Phoenix and Glendale are on this soil. Capability unit I–1 irrigated, subclass VIIc dryland; Loam Upland range site; horticultural group 1; wildlife habitat group 1 irrigated, 11 dryland.

Glenbar clay loam, saline-alkali (Gu).—This level to nearly level soil is on flood plains and low alluvial terraces along the Gila and Salt Rivers. Slopes are less than 1 percent. Areas are smooth, are oblong in shape, and range from 3 to 100 acres in size.

This soil has a profile similar to the one described as representative of the series, but it is slightly saline to strongly saline. In areas not cultivated, the surface is generally covered with a thin white crust of salt. In irrigated areas, the soil is commonly nonsaline in the upper 20 inches.

This soil is mainly well drained, but is moderately well drained to somewhat poorly drained in a few areas below canals. The available water capacity is 7 to 8 inches.

Included with this soil in mapping are small areas of Avondale clay loam, saline-alkali; Cashion clay, saline-alkali; Gadsden clay, saline-alkali; and Gilman loam, saline-alkali.

This Glenbar soil is cultivated and used as range. Irrigated crops are cotton, alfalfa, barley, sorghums, safflower, and bermudagrass pasture. Capability unit IIs–9 irrigated, subclass VIIs dryland; Saline Upland range site; horticultural group 5; wildlife habitat group 1 irrigated, 13 dryland.

Glenbar clay (Gv).—This nearly level soil is on low stream terraces and valley plains, mainly in the southern half of the Salt River and Buckeye Valleys. Areas range from 5 to 100 acres in size, but are generally 20 to 30 acres.

This soil has a profile similar to the one described as representative of the series, but the surface layer is clay and ranges from 8 to 20 inches in thickness. In dry areas it generally has cracks that are one-half inch wide and 8 to 15 inches deep.

Included with this soil in mapping are small areas of Cashion clay, saline-alkali; Gadsden clay; and Avondale clay loam; and a few areas that are darker colored than described as representative of the series.

This Glenbar soil holds 10 to 12 inches of water available for plants. It is used for cotton, alfalfa, sugar beets, barley, sorghums, and safflower. It is also used for range. Capability unit IIIs–3 irrigated, subclass VIIs dryland; Loam Upland range site; horticultural group 1; wildlife habitat group 3 irrigated, 11 dryland.

Gunsight Series

The Gunsight series consists of deep, well-drained soils. These soils formed in mixed alluvium on old alluvial fans. Slopes range from 0 to 10 percent.

In areas not cultivated, the vegetation is creosotebush, annual weeds and grasses, and scattered mesquite and paloverde trees. Elevations are 800 to 1,400 feet. The climate is arid continental. The average annual rainfall ranges from about 6 to 8 inches, the mean annual air temperature is about 68° to 72° F, and the frost-free season is 250 to 300 days.

In a representative profile the surface layer is very pale brown and yellowish-brown gravelly loam about 1 inch thick. Below this is about 2 inches of light-brown loam, 4 inches of light-brown gravelly fine sandy loam, 39 inches of light-brown very gravelly loam, and 14 inches of yellowish-red and reddish-brown very gravelly sandy clay loam. The underlying material contains many soft lime masses and semirounded lime concretions (fig. 7) and in places is weakly cemented. The soil is moderately alkaline.

Permeability is moderate. Runoff is slow to medium, and the erosion hazard is slight to moderate. The available water capacity is 3 to 4 inches. Roots penetrate to a depth of 60 inches or more.

Gunsight soils are used for irrigated crops, range, recreation, and wildlife. Irrigated crops are cotton, alfalfa, citrus, and small grain. Some areas provide a source of gravel. A few areas are used as homesites.

Representative profile of Gunsight gravelly loam in an area of Gunsight-Rillito complex, 0 to 1 percent slopes, 500 feet north and 1,870 feet east of southwest corner of sec. 9, T. 1 S., R. 6 W. in an uncultivated area south of Wintersburg:

A1—0 to 1 inch, very pale brown (10YR 7/3) and yellowish-brown (10YR 5/4) gravelly loam, light yellowish brown (10YR 6/4) and dark yellowish brown (10YR 4/4) when moist; weak, thin, platy structure; slightly hard when dry, friable when moist, slightly sticky and

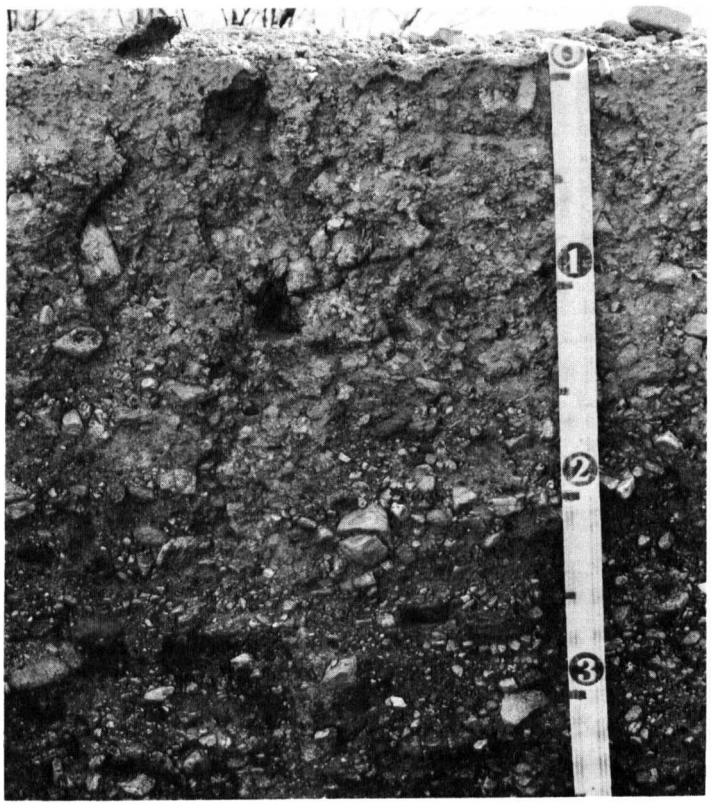

Figure 7.—**Profile of Gunsight gravelly loam. Soil is shallow over concentrations of lime.**

slightly plastic when wet; few fine roots; many fine and medium vesicular pores; 35 percent fine, medium, and coarse subangular gravel; strongly effervescent; very strongly alkaline; abrupt, smooth boundary.

C1—1 to 3 inches, light-brown (7.5YR 6/4) loam, brown (7.5YR 5/4) when moist; massive; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; few fine tubular and common fine interstitial pores; 10 percent fine, medium, and coarse subangular gravel; strongly effervescent; many, fine, distinct, pinkish-white (7.5YR 8/2) filaments of lime and few, fine, faint, soft lime masses; moderately alkaline; abrupt, smooth boundary.

C2ca—3 to 7 inches, light-brown (7.5YR 6/4) gravelly fine sandy loam, brown (7.5YR 5/4) when moist; massive; slightly hard when dry, very friable when moist, nonsticky and slightly plastic; common fine roots; common fine tubular pores; 25 percent fine, medium, and coarse subangular gravel; violently effervescent; common, fine, distinct, pinkish-white (7.5YR 8/2), soft lime masses and many, fine, distinct filaments of lime; moderately alkaline; clear, wavy boundary.

C3ca—7 to 33 inches, light-brown (7.5YR 6/4) very gravelly loam, brown (7.5YR 5/4) when moist; massive; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; few fine roots; common fine tubular and many fine interstitial pores; 50 percent fine, medium, and coarse subangular gravel; violently effervescent; common, fine and medium, distinct, pinkish-white (7.5YR 8/2), soft lime masses and common, fine, extremely hard, semi-rounded lime concretions; moderately alkaline; clear, wavy boundary.

C4ca—33 to 46 inches, light-brown (7.5YR 6/4) very gravelly loam, brown (7.5YR 5/4) when moist; massive; slightly hard when dry, very friable when moist; slightly sticky and slightly plastic when wet; common fine tubular pores; 50 percent fine, medium, and coarse subangular gravel; violently effervescent; common, fine and medium, distinct, pinkish-white (7.5YR 8/2), soft lime masses and extremely hard semirounded lime concretions; moderately alkaline; abrupt, wavy boundary.

IIB2b—46 to 67 inches, yellowish-red (5YR 5/6) and reddish-brown (5YR 5/4) very gravelly sandy clay loam, yellowish red (5YR 5/6) and reddish brown (5YR 5/4) when moist; massive; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; many fine and medium interstitial pores; 55 percent fine, medium, and coarse subangular gravel; noneffervescent in matrix, strongly effervescent in common, medium, distinct, pinkish-white (7.5YR 8/2) masses of lime or volcanic ash; few, fine, pinkish-white, soft masses of salt; moderately alkaline.

Depth to the Cca horizon ranges from 3 to 20 inches, but averages about 9 inches. The soil is commonly sandy loam or loam that is 35 to 70 percent semirounded, generally lime-coated gravel at a depth of 10 to 40 inches. In some areas about 5 to 25 percent of the coarse fragments are extremely hard, semirounded lime concretions.

In areas not cultivated, 50 to 90 percent of the surface is covered with gravel. In cultivated areas the A1 horizon is mixed with the C1 horizon and the resulting Ap horizon is 15 to 40 percent gravel. The A horizon has hue of 7.5YR and 10YR, value of 6 and 7 dry and 4 or 5 moist, and chroma of 3 or 4 dry and moist.

The C horizon has hue of 7.5YR to 10YR, value of 5 to 8 dry and 4 to 7 moist, and chroma of 2 to 4 dry and moist. In places the Cca horizon is weakly cemented and contains a few pockets of strongly cemented material.

Gunsight-Pinal complex, 1 to 10 percent slopes (GWD).—This gently sloping to moderately steep mapping unit is on old alluvial fans in the western part of the survey area. It is dissected by drainageways, 2 to 15 feet deep, at 50- to 300-foot intervals. About 30 to 70 percent of the surface area is covered with angular cobbles and gravel and a few stones. Slopes are mainly about 3 percent, but some of the larger alluvial fan tops are nearly 1 percent and some short slopes along drainageways are nearly 10 percent.

This mapping unit is about 40 percent a Gunsight cobbly loam, 30 percent a Pinal gravelly loam, and 12 percent a Pinamt cobbly loam. The Gunsight soil is on the sides and on some tops of alluvial fans. It has a profile similar to the one described as representative of the series, but the surface layer is cobbly and slopes range from 1 to 10 percent. The Pinal soil is on the tops of alluvial fans and in a few drainageways. The profile of this soil is similar to the one described as representative of the series, but slopes range from 1 to 3 percent. The Pinamt soil is on the tops and shoulders of some fans.

Included with this unit in mapping are a few areas of Rillito gravelly loam, 1 to 3 percent slopes; Antho gravelly sandy loam, 1 to 3 percent slopes; and Carrizo very gravelly sand. These included soils make up about 18 percent of the mapping unit.

This mapping unit provides grazing. Capability subclass VIIe dryland; Gunsight soil in Loam Upland range site; horticultural group 6; wildlife habitat group 11 dryland. Pinal soil in Loam Upland range site; horticultural group 7; wildlife habitat group 11 dryland.

Gunsight-Rillito complex, 0 to 1 percent slopes (GxA).—This deep, well-drained mapping unit is on old alluvial fans throughout the survey area. It is dissected by shallow stream channels spaced at 200- to 500-foot intervals. About 40 to 90 percent of the surface area is covered with gravel. Slopes range from 0 to 1 percent. Areas range from 5 to 250 acres in size, but most are less than 20 acres.

This mapping unit is about 45 percent a Gunsight gravelly loam and 45 percent a Rillito gravelly loam that has 0 to 1 percent slopes. The Gunsight soil has the profile described as representative of the series. The Rillito soil has a profile similar to the one described as representative of the series, but the surface layer is gravelly loam. The Gunsight soil is in small, oval-shaped areas near the center of alluvial fans. It is surrounded by the Rillito soil, which is in slightly lower positions.

Included with this unit in mapping are small areas of Laveen loam, 0 to 1 percent slopes, and Harqua gravelly clay loam, 0 to 1 percent slopes. Also included are a few areas of Rillito and Gunsight soils that are slightly saline to moderately saline in the lower part. The total extent of all included soils is about 10 percent.

Only a small acreage of this mapping unit is cultivated. Cotton, alfalfa, barley, and citrus are grown. The unit is also used as range. Capability unit IVs–7 irrigated, subclass VIIs dryland; Loam Upland range site; horticultural group 6; wildlife habitat group 7 irrigated, 11 dryland.

Gunsight-Rillito complex, 1 to 3 percent slopes (GxB).—This gently sloping mapping unit is on old alluvial fans. It is dissected by shallow stream channels that roughly parallel the alluvial fans. About 40 to 90 percent of the surface area is covered with gravel and a few cobbles. Slopes are convex and mainly range from 1 to 3 percent, but a few short slopes are nearly 5 percent. Areas are long and narrow and range from 3 to 40 acres in size.

This mapping unit is about 45 percent a Gunsight gravelly loam and 45 percent a Rillito gravelly loam, 1 to 3 percent slopes. Except for texture of the surface layer, the Rillito soil has a profile similar to the one described as representative of the series.

Included with this unit in mapping are a few small areas of Laveen loam, 0 to 1 percent slopes; Pinal loam, 1 to 3 percent slopes; Coolidge gravelly sandy loam, 1 to 3 percent slopes; and Harqua gravelly clay loam, 0 to 1 percent slopes. Also included are a few areas of Rillito and Gunsight soils that are moderately saline to strongly saline in the lower part. The total extent of all included soils is about 10 percent.

This mapping unit is used for range. It is not cultivated. Capability subclass VIIe dryland; Loam Upland range site; horticultural group 6; wildlife habitat group 11 dryland.

Gunsight-Rillito complex, 0 to 10 percent slopes (GYD).—This nearly level to moderately steep mapping unit is on old alluvial fans. It is dissected by a series of stream channels at about 100- to 500-foot intervals. The stream channels range from a few feet to as much as 30 feet deep. Slopes on the tops of fans are seldom more than 1 percent, but short slopes along stream channels range to 10 percent. Areas are long and narrow and range from 50 to 1,000 acres in size.

This mapping unit is about 40 percent Gunsight soils and 40 percent Rillito soils. The Gunsight soils have a profile similar to the one described as representative of the series, but the surface layer is gravelly loam, cobbly loam, and gravelly sandy loam and the soils are slightly saline below a depth of 30 inches. Gunsight soils are mainly on the top of fans. Rillito soils have a profile similar to the one described as representative of the series, but the surface layer is loam, gravelly loam, gravelly sandy loam, and sandy loam and in places the soils are slightly saline below a depth of 30 inches. The Rillito soils are in circular spots near drainageways and near the tops of fans.

Included with this unit in mapping are small areas of Perryville gravelly loam, 0 to 3 percent slopes; Laveen loam, 0 to 3 percent slopes; Pinal loam, 0 to 3 percent slopes; Gilman loam, 0 to 1 percent slopes; Antho gravelly sandy loam; 0 to 3 percent slopes; and Carrizo gravelly sandy loam, 0 to 1 percent slopes. These included soils make up about 20 percent of the mapping unit.

The mapping unit is used for range. Capability subclass VIIe dryland; Loam Upland range site; horticultural group 6; wildlife habitat group 11 dryland.

Harqua Series

The Harqua series consists of deep, well-drained soils on old alluvial fans. These soils are strongly saline and have distinct accumulations of calcium carbonate at a depth of about 12 inches. They formed in alluvium derived from granite, schist, gneiss, and rhyolite. Slopes are mostly 0 to 4 percent but range to as much as 8 percent. Elevations are 800 to 1,350 feet. The native vegetation is saltbush, creosotebush, mesquite, paloverde, and annual weeds and grasses. The average annual rainfall is 6 to 8 inches, the mean annual air temperature is 69° to 74° F, and the frost-free season is 250 to 300 days.

In a representative profile the surface layer is pinkish-gray and light reddish-brown gravelly clay loam and loam about 3 inches thick. The subsoil is reddish-brown, light reddish-brown, and pink gravelly clay loam about 25 inches thick. The underlying material is light-brown clay loam and gravelly clay loam to a depth of 60 inches. The underlying material and lower part of the subsoil contain segregations, filaments, and soft masses of lime. The soil is strongly saline and moderately alkaline.

Permeability is moderately slow. Runoff is slow to medium, and the erosion hazard is slight. The available water capacity is about 6 to 8 inches. Roots penetrate to a depth of 60 inches or more.

Harqua soils provide grazing. They are not cultivated.

Representative profile of Harqua gravelly clay loam in an area of Harqua complex, 0 to 3 percent slopes, 150 feet north and 1,550 feet south of northeast corner of sec. 13, T. 1 S., R. 9 W. in an uncultivated area at the south end of the Harquahala Valley:

A2—0 to 1 inch, pinkish-gray (7.5YR 7/2) gravelly clay loam, strong brown (7.5YR 5/6) when moist; weak, thick, platy structure; slightly hard when dry, firm when moist, sticky and plastic when wet; common vesicular pores; strongly effervescent; strongly alkaline; abrupt, smooth boundary.

A&Bsa—1 to 3 inches, pinkish-gray (7.5YR 7/2) and light reddish-brown loam, strong brown (7.5YR 5/6) and brown (7.5YR 5/4) when moist; weak, fine and medium, subangular blocky structure; slightly hard when dry, firm when moist, slightly sticky and plastic when wet; few tubular pores; strongly effervescent; moderately alkaline; abrupt, smooth boundary.

B21tsa—3 to 9 inches, reddish-brown (5YR 5/4) gravelly clay loam, yellowish red (5YR 4/6) when moist; weak, very fine, subangular blocky structure; slightly hard when dry, friable when moist, sticky and plastic when wet; many very fine interstitial pores; few thin clay films in pores; slightly effervescent; moderately alkaline; clear, smooth boundary.

B22tsa—9 to 12 inches, light reddish-brown (5YR 6/4) gravelly clay loam, reddish brown (5YR 4/4) when moist; weak, fine, subangular blocky structure; hard when dry, friable when moist, sticky and plastic when wet; common fine tubular and many fine interstitial pores; common thin clay films on peds and in pores and as bridges between sand grains; slightly effervescent; common, fine, pink (5YR 8/3), soft lime masses and salt crystals; moderately alkaline; clear, smooth boundary.

B31tcasa—12 to 20 inches, light reddish-brown (5YR 6/4) gravelly clay loam, reddish brown (5YR 4/4 and 5/4) when moist; massive; hard when dry, friable when moist, sticky and plastic when wet; common fine and very fine tubular pores; few thin clay films in pores and as bridges between sand grains; violently effervescent; many, coarse, pink (5YR 7/3) lime segregations and soft lime masses; moderately alkaline; abrupt, smooth boundary.

B32casa—20 to 28 inches, pink (7.5YR 7/4) gravelly clay loam, brown (7.5YR 5/4) when moist; massive; hard when dry, friable when moist, sticky and plastic when wet; many fine and very fine discontinuous tubular and common fine interstitial pores; few thin clay films in pores; strongly to violently effervescent; many, coarse, pinkish-white (7.5YR 8/2) filaments of lime and common, fine, pinkish-white (7.5YR 8/2), soft lime masses; moderately alkaline; abrupt, smooth boundary.

C1casa—28 to 33 inches, light-brown (7.5 YR6/4) clay loam, brown (7.5YR 5/4) when moist; massive; very hard when dry, firm when moist, slightly sticky and plastic when wet; many very fine tubular pores; very few thin clay films in pores; slightly effervescent; common, fine, pinkish-white (7.5YR 8/2), soft lime masses; moderately alkaline; abrupt, smooth boundary.

C2casa—33 to 37 inches, light-brown (7.5YR 6/4) gravelly clay loam, dark brown (7.5YR 4/4) when moist; massive; very hard when dry, firm when moist, slightly sticky and plastic when wet; many fine and very fine tubular and interstitial pores; very few clay films in pores; slightly to strongly effervescent; common, medium, pinkish-white (7.5YR 8/2), soft

lime masses; moderately alkaline; abrupt, smooth boundary.

C3casa—37 to 60 inches, light-brown (7.5YR 6/4) gravelly clay loam, brown (7.5YR 5/4) and light brown (7.5YR 6/4) when moist; massive; hard when dry, friable when moist, sticky and plastic when wet; many fine and medium tubular pores; very few thin clay films in pores; slightly to strongly effervescent; common, medium, pink (7.5YR 8/4), soft lime masses; moderately alkaline.

The solum ranges from 10 to 40 inches or more in thickness. Depth to horizons that have distinct carbonate accumulation is less than 24 inches. The B horizon is very strongly saline and is moderately alkaline to very strongly alkaline. In some places exchangeable sodium is more than 15 percent. The A horizon is moderately to very strongly alkaline. The mean annual soil temperature ranges from 72° to 78° F.

The A horizon has hue of 7.5YR or 10YR, value of 5 to 7 dry and 3 through 6 moist, and chroma of 2 to 4. It is sandy loam, gravelly loam, cobbly loam, very gravelly loam, clay loam, gravelly sandy loam, cobbly clay loam, or gravelly clay loam. The surface is commonly covered with gravel that has a thin desert varnish coating.

The B2tsa and B3tcasa horizons have hue of 7.5YR or 5YR, value of 4 to 6 dry and 3 to 5 moist, and chroma of 4 to 6. The B2tsa and B3tcasa horizons are weak to moderate subangular blocky or are massive. The B horizon is sandy clay loam, gravelly sandy clay loam, heavy loam, clay loam, gravelly loam, gravelly clay loam, or very gravelly sandy clay loam, but only the lower part of the B32casa horizon is very gravelly sandy clay loam.

The Ccasa horizon is sandy loam, clay loam, gravelly sandy clay loam, gravelly clay loam, and very gravelly clay loam. The calcium carbonate equivalent ranges from more than 15 percent in the upper part of the C horizon to less than 10 percent in the lower part. Calcium carbonate cementation in some places is very weak or weak. The content of gravel in individual horizons ranges from a few scattered pebbles to about 40 percent by volume. The content of gravel between depths of 10 and 40 inches generally is less than 35 percent by volume.

Harqua complex, 0 to 3 percent slopes (HAB).—This mapping unit consists of deep, well-drained, saline and saline-alkali soils that formed in gravelly alluvium near the ends of old alluvial fans. It is along the Centennial Wash at the south end of the Harquahala Valley and in the area south of Wintersburg. It is dissected by shallow drainageways spaced at about 100- to 500-foot intervals. About 80 to 90 percent of the surface area not near drainageways is covered with a varnished desert pavement. Slopes are dominantly about 1 percent, but some short slopes near drainageways are about 3 percent. Runoff is medium.

This mapping unit is about 35 percent a Harqua gravelly clay loam that has 0 to 1 percent slopes, and 30 percent a Harqua loam and 20 percent a Harqua gravelly clay loam, both of which have 1 to 3 percent slopes. The Harqua gravelly clay loam has the profile described as representative of the series. The Harqua loam has a profile similar to the one described as representative of the series, but it is strongly affected by saline and alkali salts. This soil is in slightly concave areas near stream channels, and the other Harqua soils are in convex areas.

Included with this unit in mapping are areas of other soils similar to the Harqua soils, but stratified clay sediment is below a depth of 20 to 40 inches. Also included are areas of Rillito gravelly loam, Gunsight gravelly loam, Casa Grande loam, and Valencia sandy loam. Included soils make up 15 percent of the unit.

This mapping unit provides grazing. Capability subclass VIIe dryland; Saline Upland range site; horticultural group 5; wildlife habitat group 14 dryland.

Harqua complex, 3 to 8 percent slopes (HAC).—This gently sloping to moderately sloping mapping unit is on severely dissected old alluvial fans that parallel Centennial Wash and Luke Wash near Wintersburg. Most of the tops of fans have slopes of 0 to 3 percent. They break abruptly into sides that have slopes of 3 to 8 percent. The areas at the base of these side slopes are less sloping. The difference in elevation from the base to the crest of each hill is 20 to 50 feet. Except for intermittent drainageways, about 60 to 90 percent of the surface is covered with a varnished desert pavement. Most of the pavement is rounded gravel and a few cobbles. Runoff is medium. Areas are long and narrow and about 30 acres in size.

This mapping unit is about 25 percent a Harqua gravelly loam that has 0 to 1 percent slopes, 20 percent a Harqua gravelly clay loam that has 1 to 3 percent slopes, and 20 percent a Harqua gravelly clay loam that has 3 to 8 percent slopes. Also, about 20 percent of the mapping unit is a very strongly alkaline and saline soil that has a thin clay loam subsoil underlain by highly stratified, weakly cemented clay sediment. This steep soil is on side slopes, and in a few areas the sediment is exposed at the surface.

Included with this unit in mapping are small areas of Rillito gravelly loam, 1 to 3 percent slopes; Gunsight gravelly loam, 1 to 3 percent slopes; and Laveen loam, saline-alkali. The total extent of all included soils is about 15 percent.

This mapping unit is used for range. It is not cultivated. Capability subclass VIIe dryland; Saline Upland range site; horticultural group 5; wildlife habitat group 14 dryland.

Harqua-Gunsight complex, 0 to 5 percent slopes (HLC).—This mapping unit is on old alluvial fans west of the Hassayampa River. Slopes are generally less than 1 percent on the fan tops, but on the sides of fans near drainageways they are as much as 5 percent. Areas are generally long and narrow and somewhat pear shaped. They range from 20 to 500 acres in size.

This mapping unit is typically about 40 percent a Harqua soil that has 0 to 1 percent slopes, about 35 percent a Gunsight soil that has 0 to 5 percent slopes, and about 20 percent a Rillito soil that has 0 to 3 percent slopes. The Harqua soil is on the broad, flat tops of alluvial fans where about 80 to 90 percent of the surface area is covered with a varnished desert pavement. It has a profile similar to the one described as representative of the series, but the surface layer is cobbly loam, cobbly clay loam, and gravelly clay loam. The Gunsight soil is on the tops and sides of alluvial fans. It has a profile similar to the one described as representative of the series, but the surface layer is gravelly loam, gravelly sandy loam, or cobbly loam. The Rillito soil is in or near shallow drainageways and in a few circular spots on the tops of fans. It has a profile similar to the one described as representative of the series, but the surface layer is gravelly loam, gravelly sandy loam, or loam.

Included with this unit in mapping are small areas of Laveen loam, 0 to 1 percent slopes; Laveen sandy loam, 0 to 1 percent slopes; Pinal gravelly loam, 0 to 1 percent slopes; and Cherioni gravelly loam, 3 to 8 percent slopes. Included soils make up about 5 percent of this unit.

This mapping unit is used for range. Capability subclass VIIe dryland. Harqua soil in Saline Upland range site; horticultural group 5; wildlife habitat group 14 dryland.

Gunsight soil in Loam Upland range site; horticultural group 6; wildlife habitat group 11 dryland.

Harqua-Laveen complex (HM).—This nearly level mapping unit is on old valley plains and alluvial fans, mainly in the southern part of the Harquahala Valley. It is dissected by shallow stream channels spaced at 300- to 500-foot intervals. Slopes are generally less than 1 percent, but in a few areas adjacent to stream channels they are nearly 2 percent.

This mapping unit is about 40 percent a Harqua gravelly clay loam that has 0 to 1 percent slopes, and 35 percent a Laveen fine sandy loam that has 0 to 1 percent slopes. The Harqua soil is on slightly convex, long, narrow ridges that are covered with a varnished desert pavement. The Laveen soil is in slightly concave swale positions in or near stream channels. It is in long narrow strips and parallels the Harqua soil. The Laveen soil has a profile similar to the one described as representative of the series, but the surface layer is fine sandy loam.

Included with this unit in mapping are a few small areas of Rillito loam, Gunsight gravelly loam, and Valencia sandy loam. The Rillito soil makes up about 15 percent of the mapping unit, and the Gunsight soil and Valencia soil each make up about 5 percent.

This mapping unit is used for range. It is not cultivated. Capability subclass VIIs dryland. Harqua soil in Saline Upland range site; horticultural group 5; wildlife habitat group 14 dryland. Laveen soil in Loam Upland range site; horticultural group 2; wildlife habitat group 11 dryland.

Harqua-Rillito complex, 1 to 3 percent slopes (HrB).—This mapping unit is on old alluvial fans and valley plains in the Harquahala Valley and in the Tonopah and Wintersburg areas. Slopes are mainly 1 to 3 percent, but a few areas in the center of alluvial fans are less than 1 percent and some short slopes range to 5 percent or more. Areas are dissected by numerous, intermittent stream channels at 200- to 500-foot intervals.

This mapping unit is about 50 percent a Harqua clay loam that has 0 to 1 percent slopes, about 20 percent a Rillito gravelly loam that has 0 to 3 percent slopes, and about 15 percent a Gunsight gravelly loam that has 1 to 3 percent slopes. The Harqua soil is in oval-shaped areas on convex ridges near the tops of alluvial fans. It is covered with a varnished desert pavement of well-rounded gravel and a few cobbles, welded tuff, andesite, basalt, granite-gneiss, and other rocks. The soil ranges from slightly to strongly saline. The Gunsight and Rillito soils are on some convex centers of alluvial fans and the steeper, concave side slopes. A few short slopes are as much as 5 percent.

Included with this unit in mapping are a few areas of Gilman loam, 0 to 1 percent slopes; Antho gravelly sandy loam, 0 to 1 percent slopes; Laveen loam, 0 to 1 percent slopes; Estrella loam; Valencia sandy loam; Tremant gravelly loam, 0 to 1 percent slopes; and Coolidge sandy loam. Included soils make up 15 percent of the unit.

This mapping unit is used for range. It is not cultivated. Capability subclass VIIe dryland. Harqua soil in Saline Upland range site; horticultural group 5; wildlife habitat group 14 dryland. Rillito soil in Loam Upland range site; horticultural group 6; wildlife habitat group 11 dryland.

La Palma Series

The La Palma series consists of moderately deep, well-drained, strongly alkaline soils underlain by an indurated silica-lime cemented pan at a depth of about 20 to 40 inches. These soils are on old valley plains and old alluvial fans in areas near Wintersburg and Luke Air Base. They formed in material derived from acid igneous rocks influenced by neutral and basic rocks. Slopes are less than 1 percent. Elevations are 800 to 1,200 feet. In areas not cultivated, the vegetation is saltbush, creosotebush, mesquite, cactus, and annual weeds and grasses. The precipitation is 6 to 8 inches, the mean annual air temperature is 69° to 73° F, and the frost-free season is 250 to 300 days.

In a representative profile the surface layer is light-brown and light yellowish-brown very fine sandy loam about 5 inches thick. The subsoil is light-brown very fine sandy loam and yellowish-red clay loam about 13 inches thick. The underlying material is about 9 inches of light-brown loam over a 2-inch, pinkish-white, silica-lime cemented pan. The soil is moderately alkaline to very strongly alkaline and strongly to violently effervescent.

Permeability is slow. Runoff is slow, and the erosion hazard is slight. The available water capacity is 3 to 5 inches. Roots penetrate to a depth of about 27 inches.

La Palma soils are used for range, irrigated crops, recreation, and wildlife. Irrigated crops are cotton, alfalfa, barley, and sugar beets.

Representative profile of La Palma very fine sandy loam, 1,600 feet east and 1,100 feet south of northwest corner sec. 2, T. 2 N., R. 1 W. in an uncultivated area near Luke Air Force Base:

A11—0 to 1½ inches, light-brown (7.5YR 6/4) very fine sandy loam, brown (7.5YR 5/4) when moist; weak, thin, platy structure; slightly hard when dry, very friable when moist, nonsticky and slightly plastic when wet; common very fine and fine roots; common fine tubular pores; strongly effervescent; moderately alkaline; abrupt, smooth boundary.

A12—1½ to 5 inches, light yellowish-brown (10YR 6/4) very fine sandy loam, brown (7.5YR 4/4) when moist; weak, thin, platy structure; slightly hard when dry, very friable when moist, nonsticky and slightly plastic when wet; common very fine and fine roots; common fine tubular pores; strongly effervescent; moderately alkaline; clear, smooth boundary.

B1tsa—5 to 7 inches, light-brown (7.5YR 6/4) heavy very fine sandy loam, brown (7.5YR 4/4) when moist; weak, medium, subangular blocky structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; common very fine and fine roots; common very fine and fine tubular pores; strongly effervescent; common, fine and medium, pinkish-white (7.5YR 8/2), irregularly shaped, soft lime masses; very strongly alkaline; abrupt, smooth boundary.

B2tcasa—7 to 11 inches, yellowish-red (5YR 5/6) and brown (7.5YR 5/4) light clay loam, dark brown (7.5YR 4/4) when moist; weak, medium, subangular blocky structure; hard when dry, friable when moist, slightly sticky and plastic when wet; common very fine and fine roots; common fine tubular pores; violently effervescent; common, fine and medium, pinkish-white (7.5YR 8/2), irregularly shaped, soft lime masses; 2 percent fine pinkish white (7.5YR 8/2) durinodes; very strongly alkaline; clear, smooth boundary.

B3tcasa—11 to 18 inches, light-brown (7.5YR 6/4) heavy loam, brown (7.5YR 5/4) when moist; massive; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; few fine roots;

common fine tubular pores; strongly effervescent; common, fine, medium and coarse, pinkish-white (7.5YR 8/2), irregularly shaped, soft lime masses; 1 percent fine gravel; very strongly alkaline; gradual, smooth boundary.

C1casa—18 to 27 inches, light-brown (7.5YR 6/4) heavy loam, brown (7.5YR 5/4) when moist; massive; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; few fine roots; common fine tubular pores; many, pinkish-white (7.5YR 8/2), strongly cemented to indurated durinodes; violently effervescent; very strongly alkaline; abrupt, wavy boundary.

C2sicam—27 to 29 inches, pinkish-white (7.5YR 8/2) silica-cemented indurated duripan, pinkish gray (7.5YR 7/2) when moist; thin laminar layer on top; extremely hard, violently effervescent; very strongly alkaline.

Depth to the duripan ranges from 20 to 40 inches, but is commonly 24 to 30 inches. In places the pan is single, indurated, and 2 inches to 2 feet thick. In other places there are several 1- to 3-inch pans separated by noncemented soil material. The soil is generally dry unless irrigated. The B and C horizons are strongly alkaline to very strongly alkaline.

The A horizon has hue of 7.5YR and 10YR, value of 5 to 7 dry and 3 to 5 moist, and chroma of 3 or 4 dry and moist. It is fine sandy loam, loam, or very fine sandy loam. The pH value ranges from 8.0 to 9.0. The B horizon has hue of 5YR, 7.5YR, and 10YR; value of 5 to 7 dry and 4 or 5 moist; and chroma of 3 or 4 dry and moist. It is heavy loam, clay loam, and sandy clay loam. This horizon is weak to moderate, fine to medium, subangular blocky or weak to moderate, fine to medium, columnar, and in places it is massive. The calcium carbonate equivalent of the B3casa horizon is generally more than 15 percent. The Cca horizon just above the duripan is loam, clay loam, or fine sandy loam.

La Palma very fine sandy loam (La).—This soil is commonly covered with a black algal crust. In some areas it has a slicked-over appearance, and in other small areas it is covered with a desert pavement. Slopes are 1 to 3 percent. Areas are oval shaped and range from 5 to 40 acres in size.

Included with this soil in mapping are small areas of Pinal loam, 0 to 1 percent slopes; Casa Grande loam; Laveen loam, saline-alkali, 0 to 1 percent slopes; and Harqua gravelly loam, 0 to 1 percent slopes. Also included are a few small areas of soils that are similar to La Palma soils but are more than 40 inches deep over an indurated pan. Included soils make up about 20 percent of the mapping unit.

This La Palma soil is used mainly for range. A few areas in fields of better soils are cultivated. Capability unit IIIs-9 irrigated, subclass VIIs dryland; Saline Upland range site; horticultural group 7; wildlife habitat group 5 irrigated, 14 dryland.

Laveen Series

The Laveen series consists of deep, well-drained soils that have a large concentration of lime in the lower part. These soils formed in alluvium on old alluvial fans and old valley plains. The alluvium was derived from granite, granite-gneiss, schist, andesite, basalt, and limestone. Slopes are 0 to 3 percent. Elevations are 800 to 1,400 feet. In areas not cultivated, the vegetation is creosotebush, cactus, and mesquite and paloverde trees. The average annual rainfall is 6 to 8 inches, the mean annual air temperature is 69° to 73° F, and the frost-free season is 250 to 300 days.

In a representative profile the surface layer is pale-brown and light-brown loam about 15 inches thick. The underlying material to a depth of 72 inches is pink loam that contains visible accumulations of lime below a depth of about 24 inches. The soil is moderately alkaline throughout.

Permeability is moderate. Runoff is slow to medium, and the erosion hazard is slight to moderate. Roots penetrate to a depth of 60 inches or more.

Laveen soils are used for irrigated crops, range, recreation, and wildlife. Irrigated crops are cotton, alfalfa, barley, sugar beets, sorghum, safflower, wheat, citrus, grapes, and vegetables.

Representative profile of Laveen loam, 0 to 1 percent slopes, 1,090 feet north and 160 feet west of southeast corner of sec. 6, T. 1 S., R. 2 E. in a cultivated field near Laveen:

Ap1—0 to 6 inches, pale-brown (10YR 6/3) loam, dark yellowish brown (10YR 4/4) when moist; massive; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; few fine roots; few fine interstitial pores; few mica flakes; strongly effervescent; moderately alkaline; abrupt, smooth boundary.

Ap2—6 to 15 inches, light-brown (7.5YR 6/4) loam, dark brown (7.5YR 4/4) when moist; massive; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; few fine roots; common fine tubular and few fine interstitial pores; strongly effervescent; moderately alkaline; abrupt, smooth boundary.

C1—15 to 24 inches, pink (7.5YR 7/4) loam, brown (7.5YR 5/4) when moist; massive; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; few fine roots; few fine interstitial and common fine tubular pores; strongly effervescent; moderately alkaline; clear, smooth boundary.

C2ca—24 to 38 inches, pink (7.5YR 7/4) loam, brown (7.5YR 5/4) when moist; massive; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; few fine roots; few fine tubular and interstitial pores; violently effervescent; common, fine and medium, irregularly shaped, pinkish-white (7.5YR 8/2), soft masses of lime and 5 to 10 percent common, medium, pinkish-white (7.5YR 8/2) lime nodules, pink (7.5YR 7/4) when moist; more than 15 percent calcium carbonate equivalent; moderately alkaline; clear, smooth boundary.

C3ca—38 to 50 inches, pink (7.5YR 7/4) loam, brown (7.5YR 5/4) when moist; massive; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; few very fine roots; few fine tubular and interstitial pores; violently effervescent; many, medium and coarse, pinkish-white (7.5YR 8/2), soft masses of lime and 15 percent common, medium and coarse, pinkish-white (7.5YR 8/2), semi-rounded lime nodules, pink (7.5YR 7/4) when moist; more than 15 percent calcium carbonate equivalent; moderately alkaline; clear, smooth boundary.

C4ca—50 to 72 inches, pink (7.5YR 7/4) gravelly loam, brown (7.5YR 5/4) when moist; massive; hard when dry, friable when moist, sticky and plastic when wet; very few very fine roots; few fine tubular and interstitial pores; violently effervescent; many, medium and coarse, pinkish-white (7.5YR 8/2), soft masses of lime and 20 percent common, fine and medium, pinkish-white (7.5YR 8/2) lime nodules, pink (7.5YR 7/4) when moist; moderately alkaline.

Depth to the Cca horizon ranges from 14 to 30 inches. The soil has hue of 7.5YR and 10YR and value of 5 to 7 dry and 4 or 5 moist. Lime nodules in the A horizon range from few to none. The A horizon ranges from sandy loam through loam to clay loam. The C horizon is commonly loam, but is very fine sandy loam in places. Size and content of lime nodules in the Cca horizon range from few fine to many medium and coarse, but the content is less below a depth of 3 feet. In many places the Cca horizon extends to a depth of more than 6 feet. Content of lime nodules is generally about 10 to 15 percent, but the calcium carbonate content is more than 15 percent.

Laveen sandy loam (Lb).—This nearly level soil is on old alluvial fans and valley plains. It occurs throughout the survey area. Slopes are slightly convex and less than 1 percent. Areas are long and narrow and about 50 acres in size.

This soil has a profile similar to the one described as representative of the series, but the surface layer is sandy loam or fine sandy loam 6 to 14 inches thick. Included in mapping are small areas of Perryville sandy loam, Coolidge sandy loam, Valencia sandy loam, and Antho sandy loam, 0 to 1 percent slopes. The total extent of all included soils seldom exceeds 15 percent.

This Laveen soil holds 8 to 11 inches of water available to plants. It is used for cotton, alfalfa, barley, sorghum, sugar beets, safflower, citrus, and vegetables. A few areas are used for range, and a few areas are used as homesites. Capability unit I–2 irrigated, subclass VIIc dryland; Loam Upland range site; horticultural group 2; wildlife habitat group 1 irrigated, 11 dryland.

Laveen loam, 0 to 1 percent slopes (LcA).—This nearly level soil is on old alluvial fans and valley plains. It occurs throughout the survey area. Slopes are slightly convex and are generally less than 1 percent. Areas are long and narrow and about 60 acres in size.

This soil has the profile described as representative of the series. Included in mapping are small areas of Gilman loam, 0 to 1 percent slopes; Mohall loam; Estrella loam; Perryville gravelly loam, 0 to 1 percent slopes; and Rillito loam, 0 to 1 percent slopes. These included soils make up about 15 percent of the mapping unit. Also included are a few spots of soils that are affected by saline and alkali salts.

This Laveen soil holds 8 to 11 inches of water available to plants. It is used for cotton, alfalfa, barley, sorghum, safflower, wheat, citrus, sugar beets, and vegetables. Parts of the cities of Phoenix and Sun City are on this soil. A few areas are used for range. Capability unit I–1 irrigated, subclass VIIc dryland; Loam Upland range site; horticultural group 2; wildlife habitat group 1 irrigated, 11 dryland.

Laveen loam, 1 to 3 percent slopes (LcB).—This gently sloping soil is on old alluvial fans and valley plains. Slopes are slightly convex. They are dominantly about 1 percent, but a few short slopes are nearly 5 percent. Runoff is medium, and the erosion hazard is moderate. Areas are long and narrow and about 20 acres in size.

Included with this soil in mapping are small areas of Perryville gravelly loam, 1 to 3 percent slopes; Gilman loam, 1 to 3 percent slopes; and Rillito loam, 1 to 3 percent slopes. Included soils make up about 10 percent of the mapping unit.

This Laveen soil holds 8 to 11 inches of water available to plants. About half of the acreage is used for range. The rest is irrigated and used for cotton, alfalfa, and barley. Capability unit IIe–1 irrigated, subclass VIIe dryland; Loam Upland range site; horticultural group 2; wildlife habitat group 1 irrigated, 11 dryland.

Laveen loam, saline-alkali (Ld).—This nearly level soil is on alluvial fans and valley plains adjacent to major stream channels. It is most extensive at the northern end of the Rainbow Valley, along Centennial Wash in the Harquahala Valley, near Luke Air Force Base, and in the area near Wintersburg. In areas not cultivated, the surface is often covered with a black, algal crust. Runoff is medium. Areas are long and narrow and about 30 acres in size.

This soil has a profile similar to the one described as representative of the series, but the underlying material is strongly alkaline to very strongly alkaline. Depth to this layer ranges from 8 to 30 inches. Salt content ranges from none to strongly saline.

Included with this soil in mapping are a few areas of Casa Grande loam; Gilman loam, saline-alkali; Estrella loam, saline-alkali; Perryville loam, saline-alkali; and Laveen loam, 0 to 1 percent slopes. The total extent of all included soils seldom exceeds 20 percent.

This Laveen soil holds 7 to 8 inches of water available to plants. It is used for irrigated crops, recreation, and wildlife. A few areas are used as range following seasonal rains. Irrigated crops are cotton, alfalfa, sorghum, barley, and safflower. Capability unit IIs–9 irrigated, subclass VIIs dryland; Saline Upland range site; horticultural group 5; wildlife habitat group 1 irrigated, 13 dryland.

Laveen clay loam (Le).—This nearly level soil is on valley plains, mainly at the northern end of the Salt River Valley. Slopes are less than 1 percent. Areas are long and narrow and about 30 acres in size.

This soil has a profile similar to the one described as representative of the series, but the surface layer differs in texture and is 8 to 14 inches thick. Included in mapping are small areas of Mohall clay loam, Trement clay loam, Vecont clay, and Tucson clay loam. Included soils make up about 15 percent of the mapping unit.

This Laveen soil holds 8 to 11 inches of water available to plants. It is used for cotton, alfalfa, sorghum, barley, sugar beets, grapes, citrus, and vegetables. Parts of the cities of Phoenix, Glendale, Sun City, and Peoria are on this soil. Some areas are used for range. Capability unit I–1 irrigated, subclass VIIc dryland; Loam Upland range site; horticultural group 2; wildlife habitat group 1 irrigated, 11 dryland.

Laveen-Antho complex, saline-alkali (Lf).—This nearly level mapping unit is on slightly convex valley plains parallel to Centennial Wash in the Harquahala Valley. Slopes are generally less than 1 percent, but a few short side slopes are nearly 2 percent. Areas are long and narrow and about 100 acres in size.

This mapping unit is about 35 percent a Laveen fine sandy loam, saline-alkali; 20 percent a Laveen sandy loam; 15 percent Antho sandy loam, saline-alkali; and 15 percent Antho sandy loam, 0 to 1 percent slopes. The Laveen fine sandy loam, saline-alkali soil has a profile similar to the one described as representative of the series, but the surface layer differs in texture and is only 6 to 12 inches thick and the soil contains excessive amounts of salt and alkali at a depth ranging from 8 to 30 inches. The Laveen sandy loam soil has a profile similar to the one described as representative of the series, but the surface layer is sandy loam 6 to 12 inches thick. The Antho sandy loam, saline-alkali soil has a profile similar to the one described as representative of the series, but contains excessive amounts of salt and alkali at a depth ranging from 15 to 30 inches. The soils in this unit are in small, intermixed, oval-shaped areas about 100 feet in diameter.

Included with this unit in mapping are small areas of Coolidge sandy loam; Gilman loam, saline-alkali; and Casa Grande sandy loam. The total extent of all included soils is about 15 percent.

A few areas of this mapping unit are cultivated and used for cotton, alfalfa, barley, and safflower. Other areas are used for range. Capability unit IIs–9 irrigated, subclass VIIs dryland. Laveen fine sandy loam, saline-alkali, in Saline Upland range site; horticultural group 5; wildlife habitat group 1 irrigated, 13 dryland; Laveen sandy loam in Loam Upland range site; horticultural group 2; wildlife habitat group 1 irrigated, 11 dryland. Antho sandy loam, saline-alkali, in Saline Upland range site; horticultural group 5; wildlife habitat group 1 irrigated, 13 dryland. Antho sandy loam, 0 to 1 percent slopes, in Loam Upland range site; horticultural group 1; wildlife habitat group 1 irrigated, 11 dryland.

Maripo Series

The Maripo series consists of deep, well-drained soils underlain by sand or gravelly loamy sand at a depth of 20 to 40 inches. These soils formed in recent alluvium deposited on alluvial fans, low stream terraces, and flood plains. The alluvium was derived from a wide variety of acid and basic igneous rocks, including mainly granite but some rhyolite, andesite, basalt, and schist. Slopes are 0 to 1 percent. Elevations are 800 to 1,450 feet. In areas not cultivated, the vegetation is creosotebush, cactus, annual weeds and grasses, and scattered mesquite and paloverde trees. The average annual rainfall is 6 to 8 inches, the mean annual air temperature is 69° to 74° F, and the frost-free season is 250 to 300 days.

In a representative profile the soil is brown and pale-brown sandy loam to a depth of about 34 inches and brown gravelly loamy sand to a depth of 60 inches. It is moderately alkaline throughout and slightly effervescent to strongly effervescent.

Permeability is moderately rapid. Runoff is medium, and the erosion hazard is slight. The available water capacity is 5 to 6 inches. Roots penetrate to a depth of 60 inches or more.

Maripo soils are used for irrigated crops, range, recreation, and wildlife. Irrigated crops are cotton, alfalfa, sorghums, barley, wheat, grapes, citrus, safflower, and truck crops. A few areas are used as homesites.

Representative profile of Maripo sandy loam, 291 feet south and 1,500 feet west of northeast corner of SW¼ sec. 10, T. 2 N., R. 2 W. in a cultivated field west of the White Tank Housing Development:

Ap—0 to 13 inches, brown (10YR 5/3) sandy loam, dark brown (10YR 4/3) when moist; massive; slightly hard when dry, very friable when moist, nonsticky and nonplastic when wet; common very fine roots; few fine tubular pores; slightly effervescent; moderately alkaline; abrupt, smooth boundary.

C1—13 to 34 inches, pale-brown (10YR 6/3) sandy loam, dark brown (10YR 4/3) when moist; massive; slightly hard when dry, very friable when moist, nonsticky and nonplastic when wet; common fine roots; common fine tubular pores; strongly effervescent; few, fine, faint, white (10YR 8/2) filaments of lime in lower part; moderately alkaline; clear, smooth boundary.

IIC2—34 to 60 inches, brown (10YR 5/3) gravelly sand, dark brown (10YR 4/3) when moist; single grained; loose when dry and moist, nonsticky and nonplastic when wet; strongly effervescent; moderately alkaline.

This soil has hue of 10YR and 7.5YR, value of 5 to 7 dry and 3 to 5 moist, and chroma of 2 to 4 dry and moist. The A horizon is sandy loam and fine sandy loam and contains a few fine pebbles. The C1 horizon ranges from sandy loam to fine sandy loam; a few finer textured or coarser textured layers occur. Filaments of lime are common in the lower part of the C1 horizon. Depth to the strongly contrasting IIC2 horizon ranges from 20 to 40 inches, but is commonly about 30 inches. The IIC2 horizon is sand, gravelly sand, or gravelly loamy sand. Gravel content ranges from 5 to 35 percent. The pH value is seldom below 8.0 and ranges to as much as 8.4.

Maripo sandy loam (Ma).—This mapping unit is parallel to intermittent stream channels. It occurs throughout the survey area, but is most extensive parallel to the east side of the White Tank Mountains. Areas are long and narrow and range from 2 to 150 acres in size, but are generally about 40 acres.

Included with this soil in mapping are small areas of Antho sandy loam, 0 to 1 percent slopes; Valencia sandy loam; Coolidge sandy loam and small areas of other soils similar to the Maripo soils, but gravelly throughout. The total extent of all included soils seldom exceeds 15 to 20 percent.

This Maripo soil is used for irrigated crops, range, recreation, and wildlife. Irrigated crops are cotton, alfalfa, sorghum, barley, wheat, grapes, citrus, safflower, and truck crops. A few areas are used as homesites. Capability unit IIIs–7 irrigated, subclass VIIs dryland; Loam Upland range site; horticultural group 4; wildlife habitat group 4 irrigated, 11 dryland.

Mohall Series

The Mohall series consists of deep, well-drained soils that have visible amounts of lime at a moderate depth. These soils formed on old alluvial fans and valley plains. The alluvium was derived from granite, rhyolite, schist, and some material from neutral and basic igneous rocks and limestone. Slopes are 0 to 1 percent. Elevations are 1,000 to 1,450 feet. In areas not cultivated, the vegetation is creosotebush, bursage, cactus, annual weeds and grasses, and scattered mesquite and paloverde trees. The average annual rainfall is 6 to 8 inches, the mean annual air temperature is 68° to 74° F, and the frost-free season is 250 to 300 days.

In a representative profile the surface layer is brown clay loam about 12 inches thick. The subsoil is yellowish-red and reddish-brown clay loam to a depth of 35 inches and light-brown loam to a depth of 42 inches. The underlying material is light-brown very fine sandy loam to a depth of 60 inches. The soil contains large concentrations of lime below a depth of 26 inches. It is moderately alkaline throughout and strongly effervescent to violently effervescent.

Permeability is moderately slow. Runoff is medium, and the erosion hazard is slight. The available water capacity is 10 to 12 inches. Roots penetrate to a depth of 60 inches or more.

Mohall soils are used for irrigated crops, range, recreation, and wildlife. Irrigated crops are cotton, alfalfa, small grains, sugar beets, sorghum, safflower, citrus, grapes, and truck crops. A few areas are used as homesites.

Representative profile of Mohall clay loam, 63 feet west and 0.3 mile south of northeast corner of sec. 33, T. 4 N., R. 1 W. in a cultivated field northeast of Beardsley:

Ap—0 to 12 inches, brown (7.5YR 5/4) clay loam, dark brown (7.5YR 4/4) when moist; massive; slightly hard when dry, friable when moist, slightly sticky and plastic when wet; common fine roots; common fine interstitial pores; strongly effervescent; moderately alkaline; abrupt, smooth boundary.

B21t—12 to 26 inches, yellowish-red (5YR 5/6) clay loam, reddish brown (5YR 4/4) when moist; weak, coarse, prismatic structure parting to weak, fine, subangular blocky; hard when dry, friable when moist, slightly sticky and plastic when wet; few fine roots; few fine tubular pores; many thin clay films on ped faces; slightly effervescent; moderately alkaline; clear, wavy boundary.

B22tca—26 to 35 inches, reddish-brown (5YR 5/4) clay loam, reddish brown (5YR 4/4) when moist; weak, medium, subangular blocky structure; hard when dry, friable when moist, slightly sticky and plastic when wet; few fine roots; common very fine tubular pores; few fine gravel; common thin clay films on peds; violently effervescent; few, fine, distinct, pink (7.5YR 8/4) lime segregations and common, fine, distinct, pink (7.5YR 8/4) (7.5YR 8/4) filaments of lime; moderately alkaline; clear, wavy boundary.

B3tca—35 to 42 inches, light-brown (7.5YR 6/4) heavy loam, brown (7.5YR 5/4) when moist; massive; hard when dry, friable when moist; slightly sticky and plastic when wet; very few fine roots; common very fine tubular pores; few thin clay films on peds; violently effervescent; few, large and medium, light-brown (7.5YR 6/4) lime segregations and common, fine and medium, extremely hard lime concretions; moderately alkaline; gradual, wavy boundary.

Cca—42 to 60 inches, light-brown (7.5YR 6/4) very fine sandy loam, brown (7.5YR 4/4) when moist; massive; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; very few very fine roots; common very fine tubular pores; strongly effervescent; common, medium, distinct, pink (7.5YR 7/4) lime mottles; few, medium, extremely hard lime concretions; moderately alkaline.

The solum ranges from 20 to 50 inches or more in thickness. Depth to carbonate accumulation ranges from 12 to 36 inches. The A horizon has hue of 7.5YR and 10YR, value of 5 to 6 dry and 3 to 5 moist, and chroma of 2 to 6 dry and moist. It is sandy loam, loam, clay loam, or clay. In areas not cultivated, the A horizon is generally noncalcareous but in cultivated areas it is mixed with part of the calcareous B horizon. The B horizon has hue of 7.5YR and 5YR, value of 5 or 6 dry and 3 to 5 moist, and chroma of 4 to 6 dry and moist. It is clay loam or sandy clay loam. It ranges from weak to medium, fine to moderate, subangular blocky. In many places, the B3 horizon is massive. In areas not cultivated, a loam B1 horizon is common. The Cca horizon has hue of 7.5YR and 5YR, value of 5 or 6 dry and 3 to 5 moist, and chroma of 4 to 6 dry and moist. It ranges from sandy loam to heavy loam. Gravel content ranges from 0 to 15 percent.

Mohall sandy loam (Mo).—This nearly level soil is on alluvial fans and valley plains. It occurs throughout the survey area. The surface is smooth. Slopes are generally less than 1 percent. Areas are oblong and are generally about 25 acres, but range from 3 to 120 acres in size.

The profile of this soil is similar to the one described as representative of the series, but the surface layer is sandy loam. It is generally about 12 inches thick, but ranges from 6 to 18 inches in thickness. In some areas the surface layer is as much as 10 percent fine to medium gravel, but in other areas it is loamy sand or fine sandy loam.

Included with this soil in mapping are small areas of Laveen sandy loam, Coolidge sandy loam, Valencia sandy loam, and Tremant loam. Each included soil makes up about 2 percent of the mapping unit.

This Mohall soil is used for cotton, alfalfa, sugar beets, small grains, truck crops, grapes, safflower, and citrus. Some areas are used for range. Capability unit I–2 irrigated, subclass VIIc dryland; Loam Upland range site; horticultural group 2; wildlife habitat group 1 irrigated, 11 dryland.

Mohall loam (Mp).—This nearly level soil is on old alluvial fans and valley plains. It occurs throughout the survey area. Slopes are generally less than 1 percent, but a few short side slopes are more than 1 percent. Areas are generally oblong. They are generally about 35 acres, but range from 4 to 600 acres in size.

The profile of this soil is similar to the one described as representative of the series, but the surface layer is loam 6 to 16 inches thick. Included in mapping are small areas of Laveen loam, 0 to 1 percent slopes; Estrella loam; Gilman loam, 0 to 1 percent slopes; and Tremant loam. Each included soil makes up about 2 percent of the mapping unit.

This Mohall soil is used for cotton, alfalfa, small grain, sorghum, sugar beets, grapes, safflower, citrus, and truck crops. Parts of the cities of Phoenix and Peoria are on this soil. Some areas are used for range. Capability unit I–1 irrigated, subclass VIIc dryland; Loam Upland range site; horticultural group 2; wildlife habitat group 1 irrigated, 11 dryland.

Mohall clay loam (Mr).—This nearly level soil is on old alluvial fans and valley plains. Slopes are slightly convex and generally less than 1 percent. Areas are long and narrow and about 90 acres in size.

This soil has the profile described as representative of the series. Included in mapping are small areas of Laveen loam, 0 to 1 percent slopes; Estrella loam; Tucson loam; Tremant loam; and Vecont loam. Included soils make up about 10 percent of the mapping unit.

This soil is used for cotton, alfalfa, sorghum, sugar beets, small grain, safflower, citrus, and vegetables. Parts of the cities of Phoenix, Peoria, and Glendale are on this soil. Some areas are used for range. Capability unit I–1 irrigated, subclass VIIc dryland; Loam Upland range site; horticultural group 2; wildlife habitat group 1 irrigated, 11 dryland.

Mohall clay (Ms).—This level to nearly level soil is on old valley plains in the southern half of the Salt River Valley. The surface area is smooth. Slopes are generally less than 1 percent. Areas range from 3 to 200 acres in size, but average about 20 acres.

The profile of this soil is similar to the one described as representative of the series, but the surface layer is clay 10 to 19 inches thick. When dry, the soil commonly has cracks at the surface ½ to 1 inch wide and 4 to 10 inches deep.

Included with this soil in mapping are small areas of Trix clay loam; Glenbar clay; Cashion clay, saline-alkali; Vecont clay; Avondale clay; and Mohall clay loam; and a few areas of Mohall clay where the surface layer is darker colored than is typical. The total extent of all included soils is about 15 to 20 percent.

This Mohall soil is used for cotton, alfalfa, small grain, sorghum, sugar beets, and safflower. Parts of the cities of Peoria and Phoenix are on this soil. Some areas are used for range. Capability unit IIIs–3 irrigated, subclass VIIs dryland; Loam Upland range site; horticultural group 2; wildlife habitat group 3 irrigated, 11 dryland.

Mohall-Tremant complex, 0 to 3 percent slopes (MTB).—This nearly level mapping unit is on valley plains dissected by shallow stream channel branches spaced at about 200- to 500-foot intervals. The surface is undulating. Slopes are generally less than 1 percent, but a few short side slopes are as much as 3 percent.

This mapping unit is about 40 percent Mohall loam, 10 percent Mohall clay loam, 20 percent a Tremant

gravelly loam that has 0 to 3 percent slopes, and 15 percent Estrella loam. These soils have profiles similar to the ones described as representative of their respective series, but the Mohall loam has a 6- to 12-inch surface layer and the Tremant soil has a surface layer of gravelly loam. Mohall soils have 0 to 1 percent slopes and are in areas surrounding Tremant gravelly loam. The surface is stable in these areas. The Tremant soil is in long, narrow, convex areas covered with a desert pavement. The Estrella soil is in small, elongated areas adjacent to or in concave stream channels. Deposition is occurring in these areas.

Included with this unit in mapping are small, oval-shaped areas of soils that have been reworked by rodents. These soils have profiles similar to Rillito and Coolidge soils and make up about 10 percent of the unit. Also included are small areas of Laveen loam, 0 to 1 percent slopes, and Gilman loam, 0 to 1 percent slopes. These soils make up about 5 percent of the unit.

This mapping unit is used for range. It is not cultivated. A few areas northwest of Beardsley are used as homesites. Capability subclass VIIs dryland; Loam Upland range site; horticultural group 2; wildlife habitat group 11 dryland.

Mohall-Laveen association (MV).—This nearly level mapping unit is on valley plains and old alluvial fans. It is dissected by shallow stream channels spaced at 200- to 500-foot intervals. Slopes are generally less than 1 percent, but are more than 1 percent in a few areas near stream channels. Areas are long and narrow and about 50 acres in size.

This mapping unit is about 25 percent Mohall clay loam, 20 percent Mohall loam, 20 percent Laveen loam, 0 to 1 percent slopes, and 15 percent Laveen sandy loam. These soils are in fairly large areas. The Mohall soils have profiles similar to the one described as representative of the series, but the Mohall loam has a 6- to 12-inch surface layer. The Laveen soils have profiles similar to the one described as representative of the series, but Laveen sandy loam has a 6- to 14-inch surface layer.

Included with this unit in mapping are a few areas of Estrella loam; Gilman loam, 0 to 1 percent slopes; and Tremant gravelly clay loam. Included soils make up about 20 percent of the unit.

This mapping unit is used for range. A few houses have been built on these soils in the area northwest of Sun City. Capability subclass VIIc dryland; Loam Upland range site; horticultural group 2; wildlife habitat group 11 dryland.

Perryville Series

The Perryville series consists of deep, well-drained soils that have large amounts of lime at or near the surface. These soils formed on old alluvial fans and stream terraces. The alluvium was derived from basalt, limestone, andesite, rhyolite, and rhyolitic tuff and some granite and quartzite. Slopes are 0 to 3 percent. Elevations are 800 to 1,400 feet. The native vegetation is creosotebush, cactus, and scattered mesquite and paloverde trees. Precipitation is 6 to 8 inches, the mean annual air temperature is 69° to 74° F, and the frost-free season is 250 to 300 days.

In a representative profile the surface layer is very pale brown gravelly loam about 8 inches thick. The underlying material is very pale brown gravelly loam and sandy loam to a depth of 65 inches and very pale brown very gravelly loamy sand to a depth of 72 inches. The soil is extremely calcareous and is moderately alkaline. The pebbles are lime nodules.

Permeability is moderate. Runoff is slow to medium, and the erosion hazard is slight to moderate depending upon slope. The available water capacity is 6 to 7 inches. Roots penetrate to a depth of 60 inches or more.

Perryville soils are used for cotton, alfalfa, small grains, sugar beets, and safflower. Parts of Sun City and Phoenix are on these soils. Some areas are used for range.

Representative profile of Perryville gravelly loam, 0 to 1 percent slopes, 615 feet north and 579 feet east of southwest corner of SE¼ of sec. 9, T. 3 N., R. 1 E. about 1.5 miles northeast of Sun City:

Ap—0 to 9 inches, very pale brown (10YR 6/3) gravelly loam, brown (10YR 5/3) and very pale brown (10YR 7/3) when moist; weak, fine, granular structure; slightly hard when dry, friable when moist, sticky and plastic when wet; few fine roots; violently effervescent; 20 percent medium and fine, white (10YR 8/2), semi-rounded lime concretions (gravel); moderately alkaline; abrupt, smooth boundary.

C1ca—9 to 16 inches, very pale brown (10YR 7/3) gravelly loam, brown (10YR 5/3) and light gray (10YR 7/2) when moist; massive; hard when dry, very friable when moist, sticky and plastic when wet; few fine roots; few fine tubular and many fine interstitial pores; violently effervescent; 35 percent white (10YR 8/2) semi-rounded lime concretions (gravel); moderately alkaline; clear, smooth boundary.

C2ca—16 to 27 inches, very pale brown (10YR 7/3) gravelly loam, brown (10YR 5/3) and very pale brown (10YR 7/3) when moist; massive; very hard when dry, friable when moist, sticky and plastic when wet; few fine roots; common fine interstitial pores; violently effervescent; 40 percent white (10YR 8/2), extremely hard, semi-rounded lime concretions (gravel); moderately alkaline; clear, smooth boundary.

C3ca—27 to 38 inches, very pale brown (10YR 7/3) gravelly loam, brown (10YR 5/3) and very pale brown (10YR 7/3) when moist; hard when dry, friable when moist, sticky and plastic when wet; few very fine roots; common fine tubular and many fine interstitial pores; violently effervescent; 24 percent white (10YR 8/2), extremely hard, semi-rounded lime concretions (gravel); moderately alkaline; clear, smooth boundary.

C4ca—38 to 56 inches, very pale brown (10YR 7/3) sandy loam, pale brown (10YR 6/3) and very pale brown (10YR 7/3) when moist; massive; very hard when dry, firm when moist, slightly sticky and slightly plastic when wet; many fine tubular pores; violently effervescent; 5 percent white (10YR 8/2), extremely hard, semi-rounded lime concretions and many soft lime masses; moderately alkaline; clear, smooth boundary.

C5ca—56 to 65 inches, very pale brown (10YR 7/3) sandy loam, dark yellowish brown (10YR 4/4) and very pale brown (10YR 7/3) when moist; massive; very hard when dry, firm when moist, slightly sticky and slightly plastic when wet; common fine tubular and interstitial pores; 10 percent cobbles; violently effervescent; many, white (10YR 8/2), semi-rounded, soft lime masses and a few lime concretions that form a weakly cemented pan in places; moderately alkaline; abrupt, smooth boundary.

IIC6—65 to 72 inches, very pale brown (10YR 7/3) very gravelly loamy sand, brown (10YR 5/3) when moist; single grained; loose when dry and moist, nonsticky and nonplastic when wet; many fine interstitial pores; about 50 percent gravel; strongly effervescent; moderately alkaline.

The soil has hue of 10YR or 7.5YR, value of 6 or 7 dry and 4 to 7 moist, and chroma of 2 to 4 dry and moist. The A horizon is loam, gravelly loam, sandy loam, gravelly sandy loam, or sandy loam. The Cca horizon is loam, gravelly loam, sandy loam, gravelly sandy loam, or very gravelly loamy sand. The soil between depths of 10 and 40 inches is more than 40 percent calcium carbonate by weight and is 15 to 35 percent coarse fragments that are mostly lime nodules or concretions. In places there is a 2- to 10-inch C1 horizon. Depth to the IIC6 horizon is 40 inches or more.

Perryville sandy loam (Pa).—This nearly level soil is on old alluvial fans, valley plains, and stream terraces. It occurs throughout the survey area, but is prevalent in the northern part of the Buckeye Valley. Slopes are slightly convex and generally less than 1 percent. Areas range from 3 to 50 acres in size, but are generally about 15 acres.

The profile of this soil is similar to the one described as representative of the series, but the surface layer is sandy loam 6 to 12 inches thick. Included in mapping are small areas of Laveen sandy loam, Coolidge sandy loam, and Rillito sandy loam, 0 to 1 percent slopes. Included soils make up about 15 percent of the mapping unit.

This Perryville soil is used for cotton, alfalfa, small grain, sugar beets, and safflower. A few areas are used as homesites. Some areas are used for range. Capability unit IIs–7 irrigated, subclass VIIs dryland; Loam Upland range site; horticultural group 6; wildlife habitat group 1 irrigated, 11 dryland.

Perryville loam, saline-alkali (Pb).—This mapping unit is on old alluvial fans and valley plains near Tonopah and Wintersburg. The surface is convex. Slopes are generally less than 1 percent, but in a few areas they are about 1.5 percent. Areas are oblong in shape and about 40 acres in size.

This soil has a profile similar to the one described as representative of the series, but it is strongly to very strongly alkaline and slightly saline to moderately saline between depths of 10 and 30 inches.

Included with this soil in mapping are small areas of Rillito loam, 0 to 1 percent slopes; Laveen loam, saline-alkali; and Coolidge sandy loam. Also included are small areas of other soils similar to Perryville soils. These soils have strata of gravelly sand and gravelly loamy sand or, in places, an older, buried soil below a depth of 30 inches. Included soils make up about 20 percent of the unit.

This Perryville soil is used for range. It is seldom cultivated. Capability unit IIIs–9 irrigated, subclass VIIs dryland; Saline Upland range site; horticultural group 5; wildlife habitat group 5 irrigated, 14 dryland.

Perryville gravelly loam, 0 to 1 percent slopes (PeA).—This nearly level soil is on old alluvial fans, valley plains, and stream terraces. It occurs throughout the survey area. Slopes are slightly convex and generally less than 1 percent. Areas range from 3 to 350 acres in size, but are generally about 15 acres.

This soil has the profile described as representative of the series. Included in mapping are small areas of Rillito loam, 0 to 1 percent slopes; Tremant loam; Coolidge sandy loam; and Laveen loam, 0 to 1 percent slopes. The Rillito soil makes up about 10 percent of the mapping unit and each of the other included soils about 4 percent.

This Perryville soil is used for cotton, alfalfa, safflower, barley, and sugar beets. Parts of Sun City and Phoenix are on this soil. Some areas are used for range. Capability unit IIs–7 irrigated, subclass VIIs dryland; Loam Upland range site; horticultural group 6; wildlife habitat group 1 irrigated, 11 dryland.

Perryville gravelly loam, 1 to 3 percent slopes (PeB).—This gently sloping soil is on old alluvial fans and stream terraces. It occurs throughout the survey area, but is most extensive near Perryville and McMicken Dam. Slopes are generally convex. They range from 1 to 3 percent, but a few short side slopes are nearly 5 percent. Runoff is medium, and the erosion hazard is moderate. Areas range from 2 to 108 acres in size, but are generally about 15 acres.

Included with this soil in mapping are small areas of Rillito loam, 1 to 3 percent slopes; Laveen loam, 1 to 3 percent slopes; and Coolidge sandy loam. Also included are a few areas of soils near Tonopah and Wintersburg that are affected by saline and alkali salts and a few areas where the surface layer is gravelly sandy loam. Included soils make up about 20 percent of the mapping unit.

This Perryville soil is used for cotton, alfalfa, small grains, and safflower. A few areas are used as homesites, and a few areas are used for range. Capability unit IIe–7 irrigated, subclass VIIe dryland; Loam Upland range site; horticultural group 6; wildlife habitat group 1 irrigated, 11 dryland.

Perryville-Rillito complex, 0 to 3 percent slopes (PRB).—This nearly level to gently sloping mapping unit is on old alluvial fans and valley plains. It is dissected by shallow stream channels, 1 foot to 3 feet deep, at about 50- to 200-foot intervals. Slopes are generally slightly convex and less than 1 percent, but a few short side slopes are nearly 3 percent.

This mapping unit is about 35 percent a Perryville loam that has 0 to 1 percent slopes, 30 percent a Rillito gravelly loam that has 0 to 1 percent slopes, 10 percent a Perryville sandy loam that has 1 to 3 percent slopes, and 10 percent Rillito gravelly sandy loam that has 1 to 3 percent slopes. Perryville soils surround Rillito soils and are nearly gravel free. Rillito soils are on slightly higher, ridgelike positions, and 20 to 50 percent of the surface is covered with gravel.

Included with this unit in mapping are small areas of Antho sandy loam, 0 to 1 percent slopes; Coolidge sandy loam; Laveen sandy loam; and Gunsight gravelly loam, 0 to 1 percent slopes. Included soils make up about 15 percent of the mapping unit.

This mapping unit is used for range. It is not cultivated. Capability subclass VIIs dryland; Loam Upland range site; horticultural group 6; wildlife habitat group 11 dryland.

Pinal Series

The Pinal series consists of shallow, well-drained soils that are less than 20 inches deep over a silica-lime cemented hardpan. These soils formed in old, gravelly or cobbly valley-fill material derived from mixed rocks on old alluvial fans and stream terraces. The rocks are chiefly granite, andesite, basalt, limestone, and tuff. Slopes are 0 to 3 percent. Elevations are 800 to 1,400 feet. In areas not irrigated, the vegetation is creosotebush, paloverde trees, cholla cactus, and ocotillo. The average annual rainfall is 6 to 8 inches, the mean annual air temperature is 70° to 74° F, and the frost-free season is 270 to 320 days.

In a representative profile the surface layer is light yellowish-brown loam about 8 inches thick. The underlying material is light yellowish-brown cobbly loam to a depth of 12 inches. It is underlain by a white, indurated, silica-lime cemented hardpan. The soil is strongly alkaline and calcareous throughout.

Permeability is moderate in the upper part, but the pan is nearly impermeable. Runoff is medium, and the erosion hazard is slight to moderate. The available water capacity is 1 to 2 inches. Roots penetrate to a depth of less than 20 inches.

Pinal soils are used for range and are seldom cultivated. A few areas are used as homesites.

Representative profile of Pinal loam, 0 to 1 percent slopes, 170 feet south and 10 feet east of northwest corner of NE¼NW¼ of sec. 2, T. 2 N., R. 1 W. in an uncultivated area near Luke Air Force Base:

A1—0 to 8 inches, light yellowish-brown (10YR 6/4) loam, dark brown (10YR 4/3) when moist; weak, coarse, platy structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; many very fine roots; common very fine tubular pores; strongly effervescent; strongly alkaline; abrupt, smooth boundary.

C1ca—8 to 12 inches, light yellowish-brown (10YR 6/4) cobbly loam, dark brown (10YR 4/3) when moist; massive; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; many very fine roots; many very fine tubular pores; coarse fragments are 50 percent rock and 50 percent duripan fragments; violently effervescent; strongly alkaline; abrupt, smooth boundary.

C2sicam—12 inches, white (10YR 8/2), indurated, silica-lime cemented duripan that has thin laminar layer on upper surface, very pale brown (10YR 7/3) when moist; violently effervescent; very strongly alkaline.

Depth to the silica-lime cemented duripan ranges from 4 to 20 inches. The A and C1 horizons have hue of 10YR to 7.5YR, value of 5 to 7 dry and 4 or 5 moist, and chroma of 1 to 4 dry and moist. These horizons range from very fine sandy loam to loam and the gravelly or cobbly analogs of each. About half of the coarse fragments are angular pan fragments and half are rock. In places the pan consists of several ½- to 2-inch strongly cemented layers separated by strata of soft material. In places the soil contains excessive amounts of salt.

Pinal loam, 0 to 1 percent slopes (PsA).—This nearly level soil is on old stream terraces, mainly along the Agua Fria River near Luke Air Force Base. The surface is slightly convex. Slopes are generally less than 1 percent. Areas range from 3 to 40 acres in size.

This soil has the profile described as representative of the series. Included in mapping are small areas of Pinal loam, 1 to 3 percent slopes; La Palma very fine sandy loam; Toltec loam; Gunsight gravelly loam that has 0 to 1 percent slopes; and a few small areas of soils that are more than 20 inches deep over the pan. The total extent of all included soils seldom exceeds 15 percent of the mapping unit.

This Pinal soil is cultivated only when it is within fields of better soils. It is used for range. Capability unit IVs–5 irrigated, subclass VIIs dryland; Loam Upland range site; horticultural group 7; wildlife habitat group 7 irrigated, 11 dryland.

Pinal loam, 1 to 3 percent slopes (PsB).—This gently sloping soil is on old alluvial fans at the base of mountains and low hills. The surface is convex. Slopes range from 1 to 3 percent, but in a few areas are nearly 9 percent. The erosion hazard is moderate. Areas range from 5 to 50 acres in size.

Included with this soil in mapping are a few areas of a Gunsight gravelly loam that has 1 to 3 percent slopes; Coolidge gravelly sandy loam, 1 to 3 percent slopes; La Palma very fine sandy loam; Rillito loam, 1 to 3 percent slopes; and a Cherioni very gravelly fine sandy loam that has 3 to 5 percent slopes. Also included are some areas of soils near the base of mountains that have more than 15 percent of the surface covered with gravel and have weakly to strongly cemented pans. The total extent of all included soils seldom exceeds 20 percent of the mapping unit.

This Pinal soil is used for range. It is not cultivated. Capability subclass VIIe dryland; Loam Upland range site; horticultural group 7; wildlife habitat group 11 dryland.

Pinal gravelly loam (PT).—This nearly level to gently sloping soil is on old alluvial fans around the margins of low hills and mountains and on stream terraces. Some fans extend several miles from the mountains. On the tops of fans slopes are seldom more than 1 percent, but short side slopes are as much as 3 percent. Areas are oblong and range from 100 to 500 acres in size.

The profile of this soil is similar to the one described as representative of the series, but 30 to 40 percent of the surface is covered with gravel and a few cobbles and about 60 percent of the gravel is pan fragments. Some areas are cobbly. Areas on the sides of fans near drainageways are generally shallower over the indurated pan and the pan is often exposed.

Included with this soil in mapping are a few areas of soils on the tops of fans that are more than 20 inches deep over the pan, a few areas where the pan is only strongly cemented, and some areas north of Phoenix where slopes are nearly 10 percent. Also included are a few areas of a Gunsight gravelly loam that has 0 to 1 percent slopes and Cherioni very gravelly loam, 1 to 3 percent slopes. Included soils make up about 15 percent of the mapping unit.

This Pinal soil is used for range. It is not cultivated. Capability subclass VIIs dryland; Loam Upland range site; horticultural group 7; wildlife habitat group 11 dryland.

Pinal-La Palma loams, 1 to 3 percent slopes (PvB).—This gently sloping mapping unit is on old stream terraces in the vicinity of Luke Air Force Base. The soils are very shallow, shallow, and moderately deep. Ridges are low, and side slopes are short. Slopes are 1 to 3 percent. The erosion hazard is moderate.

This mapping unit is about 50 percent Pinal loam, 1 to 3 percent slopes; 25 percent La Palma very fine sandy loam; and 15 percent Toltec loam. The Pinal soil is on the highest positions. It is on long, narrow, convex, ridge-like positions and is hummocky. The La Palma soil is on slightly concave side slopes. These small, circular areas are at the outer edges of areas of the Pinal soil. The Toltec soil is in concave swales 1 foot to 5 feet below the surface.

Included with this unit in mapping are areas of Laveen loam, saline-alakli, and some areas of Pinal soils that are strongly alkaline. The total extent of all included soils seldom exceeds 10 percent.

This mapping unit is used for range. It is not cultivated. Capability subclass VIIe dryland. Pinal soil in Loam Upland range site; horticultural group 7; wildlife habitat group 11 dryland. La Palma soil in Saline Upland range site; horticultural group 5; wildlife habitat group 14 dryland.

Pinal-Suncity complex, 0 to 3 percent slopes (PWB).—This nearly level to gently sloping mapping unit is on very old alluvial fans and stream terraces. It is most extensive about 4 miles north of Sun City, on both sides of the Agua Fria River. Slopes are generally less than 1 percent, but in a few areas near the base of the mountains they are nearly 3 percent. In some areas the surface is almost gravel free, but in other areas the gravel content ranges to as much as 90 percent.

This mapping unit is about 55 percent a Pinal gravelly loam that has 0 to 3 percent slopes and 35 percent a Suncity gravelly loam. The Pinal soil has a profile similar to the one described as representative of the series, but the surface is covered with gravel. The Suncity soil has the profile described as representative of the series. The Suncity soil is in oval areas about 50 feet in diameter. It is surrounded by the Pinal soil.

Included with this unit in mapping are small areas of Beardsley and Gunsight soils. Included soils make about 10 percent of the unit.

This mapping unit is used for range. It is not cultivated. A few areas are used as homesites. Capability subclass VIIs dryland; Loam Upland range site; horticultural group 7; wildlife habitat group 11 dryland.

Pinamt Series

The Pinamt series consists of deep, well-drained soils. These soils formed on old alluvial fans at the base of mountains. The alluvium was derived from stratified very gravelly alluvium from mixed rock, including granite, granite-gneiss, basalt, rhyolite, andesite, and quartzite. Slopes are dominantly 0 to 5 percent, but range to as much as 10 percent. Elevations are 900 to 1,800 feet. The vegetation is creosotebush, bursage, cactus, and scattered paloverde, mesquite, and ironwood trees. Precipitation is 6 to 8 inches, the mean annual air temperature ranges from 69° to 74° F, and the frost-free season is 250 to 300 days.

In a representative profile the surface layer is light-brown very cobbly loam about 2 inches thick. The subsoil is about 33 inches thick. The upper 4 inches is light-brown very gravelly sandy loam, the next 16 inches is yellowish-red very gravelly sandy clay loam, and the lower 13 inches is yellowish-red very cobbly sandy loam. The underlying material is very pale brown very gravelly sandy loam. The lower part of the subsoil and the underlying material contain large amounts of lime. The soil is moderately alkaline.

Permeability is moderately slow. Runoff is medium, and the erosion hazard is moderate. The available water capacity is 4 to 6 inches. Roots penetrate to a depth of more than 60 inches.

Pinamt soils are used for range. They are not cultivated.

Representative profile of Pinamt very cobbly loam in an area of Pinamt-Tremant complex, 1 to 10 percent slopes, 117 feet north and 132 feet east of W¼ corner of sec. 3, T. 2 S., R. 1 W. in an uncultivated area in the Rainbow Valley:

A1—0 to 2 inches, light-brown (7.5YR 6/4) very cobbly loam, dark brown (7.5YR 4/4) when moist; weak, thin, platy structure; slightly hard when dry, friable when moist, slightly sticky and plastic when wet; common fine and very fine roots; common fine vesicular and common interstitial pores; 60 percent gravel and cobbles; slightly effervescent; moderately alkaline; abrupt, wavy boundary.

B1—2 to 6 inches, light-brown (7.5YR 6/4) very gravelly sandy loam, brown (7.5YR 5/4) when moist; massive; soft when dry, loose when moist, slightly sticky and nonplastic when wet; common fine and very fine roots; many fine interstitial and few fine tubular pores; 80 percent gravel and cobbles; slightly effervescent; moderately alkaline; clear, wavy boundary.

B2tca—6 to 22 inches, yellowish-red (5YR 5/6) very gravelly sandy clay loam, yellowish red (5YR 4/6) when moist; weak, medium, subangular blocky structure; hard when dry, friable when moist, sticky and plastic when wet; common very fine and fine roots; common fine tubular and interstitial pores; few thin clay films on peds; 60 percent gravel and cobbles; strongly effervescent; common, medium, white (10YR 8/2) filaments of lime and lime spots, very pale brown (10YR 7/3) when moist; moderately alkaline; clear, smooth boundary.

B3ca—22 to 35 inches, yellowish-red (5YR 5/6) very cobbly sandy loam, yellowish red (5YR 4/6) when moist; massive; slightly hard when dry, friable when moist, nonsticky and nonplastic when wet; very few fine roots; few fine tubular and many fine interstitial pores; 80 percent gravel and cobbles; violently effervescent; common, medium, white (10YR 8/2) filaments of lime, very pale brown (10YR 7/3) when moist; moderately alkaline; gradual, wavy boundary.

Cca—35 to 60 inches, very pale brown (10YR 7/4) very gravelly sandy loam, strong brown (7.5YR 5/6) and reddish yellow (7.5YR 6/6) when moist; massive; slightly hard when dry, very friable when moist, nonsticky and nonplastic when wet; very few fine roots; few fine tubular and common fine interstitial pores; 50 percent gravel and cobbles; violently effervescent; common, medium, white (10YR 8/2) lime spots and soft masses; moderately alkaline.

The solum ranges from 15 to 48 inches in thickness. The soil is dry in most years. About 30 to 80 percent of the surface is covered with gravel, cobbles, and stones. Mean annual soil temperature ranges from 72° to 80° F. The A1 and B1 horizons are noncalcareous to slightly calcareous, and the B2tca, B3ca, and Cca horizons are strongly calcareous to violently calcareous. Calcium carbonate content of the Cca horizon ranges from 8 to 25 percent.

The A1 horizon has hue of 10YR or 7.5YR, value of 4 to 6 dry and 3 to 5 moist, and chroma of 3 or 4. It is gravelly and very gravelly or cobbly and very cobbly sandy loam, loam, or sandy clay loam. The content of gravel and cobbles ranges from 30 to 90 percent. In places there is a thin, discontinuous A2 horizon. The B1 and B2t horizons commonly have hue of 7.5YR or 5YR, but hue ranges from 7.5YR to 2.5YR. They have value ranging from 4 to 6 dry and 3 to 5 moist and chroma of 4 to 6. These horizons are dominantly very gravelly sandy loam, very gravelly sandy clay loam, very gravelly loam, or very gravelly clay loam. They are 35 to 90 percent coarse fragments. Structure is mainly weak or moderate, fine or medium, subangular blocky, but as the content of coarse fragments increases the horizons tend to be structureless. Few or common, fine or medium spots and filaments of soft lime are in the lower part of the B2tca horizon. In places the Cca horizon is weakly cemented. It ranges from slightly hard to very hard when dry and very friable to firm when moist.

Pinamt-Tremant complex, 1 to 10 percent slopes (PYD).—This gently sloping to steep mapping unit is on old alluvial fans that radiate out from the Estrella and White Tank Mountains. It is dissected by shallow stream channels at about 50- to 100-foot intervals. Elevations range from 2 to 20 feet from the bottom of drainageways to the top of the fans. Slopes generally are about 3 percent, but side slopes of fans range to as much as 10 percent. About 40 to 80 percent of the surface is covered with angular cobbles, gravel, and a few stones.

This mapping unit is about 40 percent Pinamt very cobbly loam and 30 percent Tremant soils. The Pinamt soil is on some side slopes and the upper slopes of alluvial fans. It has the profile described as representative of the series.

About 30 to 80 percent of the surface is covered with cobbles, gravel, and a few stones. Slopes range from 2 to 10 percent. The Tremant soils are in the center of alluvial fans. They have profiles similar to the one described as representative of the series, but their surface layer ranges from gravelly sandy loam to gravelly clay loam. About 20 to 50 percent of the surface is covered with gravel and a few stones and cobbles. Slopes range from 1 to 3 percent.

Included with this unit in mapping are areas of a Gunsight gravelly loam that has 3 to 10 percent slopes; Altho gravelly sandy loam, 1 to 3 percent slopes; a Rillito gravelly loam that has 1 to 3 percent slopes; Ebon gravelly loam that has 1 to 3 percent slopes; and a Carrizo gravelly sandy loam that has 1 to 3 percent slopes. Included soils make up about 30 percent of the unit.

This mapping unit is used for range. It is not cultivated. Capability subclass VIIe dryland. Pinamt soils in Clay Upland range site; horticultural group 2; wildlife habitat group 11 dryland. Tremant soils in Loam Upland range site; horticultural group 2; wildlife habitat group 11 dryland.

Rillito Series

The Rillito series consists of deep, well-drained soils that are high in content of lime. These soils formed on old alluvial fans and stream terraces in alluvium derived from a wide variety of rock, including andesite, basalt, granite-gneiss, schist, and limestone. Slopes range from 0 to 20 percent. Elevations are 800 to 1,400 feet. The vegetation is creosotebush, cactus, annual weeds and grasses, and scattered mesquite and paloverde trees. The climate is arid continental. The average annual rainfall is 6 to 8 inches, the mean annual air temperature is 68° to 71° F, and the frost-free season is 250 to 300 days.

In a representative profile the surface layer is very pale brown loam about 2 inches thick. The underlying material is 8 inches of light yellowish-brown fine sandy loam, 9 inches of light-brown gravelly loam, and 56 inches of pink, pinkish-white, very pale brown, and light yellowish-brown gravelly loam and gravelly sandy loam. The underlying material contains soft masses, filaments, and concretions of lime. The soil is moderately alkaline throughout.

Permeability is moderate. Runoff is slow to medium, and the erosion hazard is slight to moderate depending on slope. The available water capacity is 5 to 8 inches. Roots penetrate to a depth of 60 inches and more.

Rillito soils are used for irrigated crops, recreation, wildlife, and range. Irrigated crops are cotton, alfalfa, small grain, safflower, and citrus. A few areas are used as homesites.

Representative profile of Rillito loam, 0 to 1 percent slopes, 820 feet north and 2,500 feet east of southwest corner sec. 9, T. 1 S., R. 6 W. in an uncultivated area south of Wintersburg:

A1—0 to 2 inches, very pale brown (10YR 7/3) loam, brown (7.5YR 5/4) when moist; weak, fine, granular structure; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; common fine roots; few fine tubular pores; 8 percent fine, medium, and coarse subangular gravel; strongly effervescent; moderately alkaline; abrupt, smooth boundary.

C1—2 to 10 inches, light yellowish-brown (10YR 6/4) fine sandy loam, brown (7.5YR 5/4) when moist; massive; slightly hard when dry, very friable when moist, nonsticky and slightly plastic when wet; common fine roots; few fine tubular pores; strongly effervescent; common, fine, pinkish-white (7.5YR 8/2) filaments of lime, light brown (7.5YR 6/4) when moist; moderately alkaline; clear, wavy boundary.

C2ca—10 to 19 inches, light-brown (7.5YR 6/4) gravelly loam, brown (7.5YR 5/4) when moist; massive; slightly hard when dry, very friable when moist, nonsticky and slightly plastic when wet; few medium and common fine roots; few fine tubular pores; 25 percent fine, medium, and coarse, subangular, lime-coated gravel; violently effervescent; many, fine and medium, pinkish-white (7.5YR 8/2) filaments of lime; common, medium, soft lime masses and lime concretions, light brown (7.5YR 6/4) when moist; moderately alkaline; clear, wavy boundary.

C3ca—19 to 32 inches, pink (7.5YR 7/4) gravelly loam, light brown (7.5YR 6/4) when moist; massive; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; common fine roots; common fine tubular and interstitial pores; 30 percent fine, medium, and coarse, subangular, lime-coated gravel; violently effervescent; many, medium, pinkish-white (7.5YR 8/2) filaments of lime, soft masses of lime, and lime concretions; moderately alkaline; clear, wavy boundary.

C4ca—32 to 41 inches, pinkish-white (7.5YR 8/2), weakly lime-cemented gravelly sandy loam and pockets of pink (7.5YR 7/4) material, pink (7.5YR 8/4 and 7/4) and light brown (7.5YR 6/4) when moist; massive; extremely hard when dry, weakly cemented material very firm and uncemented part very friable when moist, slightly sticky and slightly plastic when wet; few medium and common fine roots; few fine interstitial pores; 40 percent fine, medium, and coarse, subangular, lime-coated gravel; violently effervescent; common, medium, pinkish-white (7.5YR 8/2) soft lime masses and semirounded lime concretions, pink (7.5YR 8/4 and 7/4) when moist; moderately alkaline; clear, wavy boundary.

C5ca—41 to 59 inches, very pale brown (10YR 7/3) gravelly loam, light brown (7.5YR 6/4) when moist; massive; hard and very hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; few fine roots; many fine tubular pores; 25 percent fine, medium, and coarse, subangular, lime-coated gravel; violently effervescent; common, medium, very pale brown (10YR 8/3), soft lime masses and semirounded lime concretions; moderately alkaline; abrupt, wavy boundary.

C6—59 to 75 inches, light yellowish-brown (10YR 6/4) gravelly sandy loam, dark brown (7.5YR 4/4) when moist; massive; slightly hard when dry, very friable when moist, nonsticky and nonplastic when wet; few fine and medium tubular pores; many medium interstitial pores; 45 percent fine, medium, and coarse, subangular gravel; strongly effervescent; few, medium, very pale brown (10YR 8/3) lime concretions, pink (7.5YR 7/4) when moist; moderately alkaline.

The soil has hue of 7.5YR and 10YR, value mainly of 5 to 7 dry and 4 to 6 moist, and chroma of 3 to 4 dry and moist. The Cca horizon, however, has value of 8 and chroma of 2 or less. The soil ranges from strongly to violently effervescent and is mildly to strongly alkaline. Depth to the Cca horizon ranges from 4 to 14 inches.

The A horizon is loam, sandy loam, gravelly loam, and gravelly sandy loam. Between depths of 10 and 40 inches the texture averages gravelly sandy loam or gravelly loam. In places there are strata of finer or coarser material. The content of coarse fragments ranges from 5 to 60 percent in any one horizon, but averages 15 to 35 percent. The Cca horizon is weakly cemented to noncemented and has few to many semirounded lime concretions.

Rillito sandy loam, 0 to 1 percent slopes (RaA).—This nearly level soil is on old alluvial fans and stream terraces. Unless leveled, slopes are convex and are less than 1

percent. Areas are dissected by shallow stream channels at 100- to 500-foot intervals. They are generally oval in shape and about 10 acres in size.

The soil has a profile similar to the one described as representative of the series, but the surface layer is sandy loam 6 to 12 inches thick.

Included with this soil in mapping are small areas of Coolidge sandy loam, Laveen sandy loam, Tremant loam, Perryville sandy loam, and Pinal loam, 0 to 1 percent slopes. The total extent of all included soils is about 20 percent.

This Rillito soil is used for irrigated crops, range, recreation, wildlife, and a few homesites. Irrigated crops are cotton, alfalfa, small grain, safflower, and citrus. Capability unit IIs–6 irrigated, subclass VIIs dryland; Loam Upland range site; horticultural group 6; wildlife habitat group 2 irrigated, 11 dryland.

Rillito sandy loam, 1 to 3 percent slopes (RaB).—This gently sloping soil is on old alluvial fans. In most places slopes are convex. The erosion hazard is moderate. Areas are long and narrow and about 50 acres in size.

This soil has a profile similar to the one described as representative of the series, but the surface layer is sandy loam 8 to 10 inches thick.

Included with this soil in mapping are small areas of Laveen sandy loam; Coolidge gravelly sandy loam, 1 to 3 percent slopes; Perryville gravelly sandy loam, 1 to 3 percent slopes; and Pinal loam, 0 to 1 percent slopes. Also included are a few areas where slopes are short and are more than 3 percent and a few areas where the surface is gravelly. The total extent of all included soils is about 20 percent.

This Rillito soil is used for irrigated crops and range. A few areas are used as homesites. Only a small acreage is cultivated. Irrigated crops are cotton, alfalfa, barley, safflower, and citrus. Capability unit IIe–6 irrigated, subclass VIIe dryland; Loam Upland range site; horticultural group 6; wildlife habitat group 2 irrigated, 11 dryland.

Rillito loam, 0 to 1 percent slopes (RbA).—This nearly level soil is on old alluvial fans. Slopes are generally less than 1 percent and are slightly convex. Except in cultivated areas, surface drainage is provided by a dendritic pattern of shallow stream channels at 50- to 200-foot intervals. Areas are long and narrow and about 20 acres in size. The soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Laveen loam, 0 to 1 percent slopes; Perryville gravelly loam, 0 to 1 percent slopes; Coolidge sandy loam; and Tremant loam. Also included are a few leveled areas where the gravelly underlying material has been exposed. The total extent of all included soils is about 20 percent.

This Rillito soil is used for irrigated crops, range, recreation, wildlife, and a few homesites. Irrigated crops are cotton, alfalfa, barley, safflower, and citrus. Capability unit IIs–6 irrigated, subclass VIIs dryland; Loam Upland range site; horticultural group 6; wildlife habitat group 2 irrigated, 11 dryland.

Rillito loam, 1 to 3 percent slopes (RbB).—This gently sloping soil is on old alluvial fans. Slopes are convex. They are typically less than 2 percent, but a few are short and are as much as 5 percent. The erosion hazard is moderate. Surface drainage is provided by a dendritic pattern of shallow stream channels spaced at 50- to 400-foot intervals. Areas are long and narrow and about 20 acres in size.

The soil has a profile similar to the one described as representative of the series, but the surface layer is loam about 10 inches thick and depth to the gravelly underlying material is 2 to 10 inches less than in the representative profile.

Included with this soil in mapping are small areas of Laveen loam, 1 to 3 percent slopes; Perryville gravelly loam, 1 to 3 percent slopes; and Pinal loam, 1 to 3 percent slopes. The total extent of all included soils seldom exceeds 20 percent.

This Rillito soil is used for irrigated crops, range, recreation, wildlife, and a few homesites. The only acreages cultivated are those in fields of better soils. The crops are cotton, alfalfa, safflower, and citrus. Capability unit IIe–6 irrigated, subclass VIIe dryland; Loam Upland range site; horticultural group 6; wildlife habitat group 2 irrigated, 11 dryland.

Rillito-Harqua complex, 1 to 3 percent slopes (RhB).—This mapping unit is on old alluvial fans in the Harquahala Valley and in the Tonopah area. It is dissected by numerous shallow intermittent stream channels at 200- to 500-foot intervals. Slopes are mainly 1 to 3 percent, but in a few areas they are less than 1 percent and in some they are short and as much as 5 percent. The erosion hazard is moderate. Areas are long and narrow and about 250 acres in size.

This mapping unit is about 30 percent Rillito gravelly loam, Rillito gravelly sandy loam, and Rillito sandy loam; about 30 percent Harqua gravelly clay loam, Harqua gravelly loam, and Harqua loam; and about 30 percent Gunsight gravelly loam and Gunsight gravelly sandy loam. Rillito and Gunsight soils are near the center of alluvial fans and on steeper side slopes. Harqua soils occur as small oval areas also near the center of the alluvial fans. They are slightly saline to strongly saline and are covered with a varnished desert pavement. Each soil has a profile similar to the one described as representative of its respective series, but the texture of the surface layer varies.

Included with this unit in mapping are areas of Gilman loam, 0 to 1 percent slopes; Gilman fine sandy loam; Antho gravelly sandy loam, 0 to 1 percent slopes; Antho sandy loam, 0 to 1 percent slopes; Carrizo gravelly sandy loam; Valencia sandy loam, saline-alkali; Estrella loam; and Estrella loam, saline-alkali. Included soils make up up about 10 percent of the mapping unit.

Only a small acreage within fields of better soils is cultivated. The rest is used for range. Capability subclass VIIe dryland. Rillito soils in Loam Upland range site; horticultural group 6; wildlife habitat group 11 dryland. Harqua soils in Saline Upland range site; horticultural group 5; wildlife habitat group 14 dryland.

Rillito-Perryville complex, 5 to 20 percent slopes (RpE).—This mapping unit is on remnants of old stream terraces and alluvial fans that are 10 to 75 feet higher than the surrounding soils. It is most extensive in the vicinity of Luke Air Force Base and Litchfield Park. Slopes are complex, are typically 5 to 15 percent but range to 20 percent, and are 50 to 500 feet long. Intermittent drainageways dissect the area at 50- to 200-foot intervals leaving many V-shaped gullies 5 to 20 feet deep. Runoff is medium, and the erosion hazard is moderate.

This mapping unit is 30 percent Rillito gravelly loam and Rillito sandy loam; 30 percent Perryville gravelly loam; 15 percent Gunsight gravelly loam and Gunsight gravelly sandy loam; and 15 percent Pinal gravelly loam. The Rillito, Gunsight, and Pinal soils are on the crests and sides of ridge and hill remnants of dissected old stream terraces and alluvial fans where slopes are dominantly 5 to 15 percent. Perryville soils are in small depressions where slopes are 5 to 8 percent. Each soil has a profile similar to the one described as representative of its respective series, but the texture of the surface layer varies.

Included with this unit in mapping are small areas of Harqua soils and areas of Calciorthids and Torriorthents, eroded, that are strongly saline or alkali, or both. Included soils make up about 10 percent of the unit.

This mapping unit is used for grazing. It is not cultivated. Capability subclass VIIe dryland; Loam Upland range site; horticultural group 6; wildlife habitat group 11 dryland.

Rock Outcrop

Rock outcrop is exposed bedrock, mainly granite-gneiss, schist, welded tuff, and basalt. It occurs in intricate patterns and is mapped with shallow and very shallow soils in steep mountainous areas and on low hills. Slopes range from less than 3 to more than 80 percent. Rock outcrop is suitable only for recreation, wildlife habitat, water supply, and esthetic purposes.

Rock outcrop-Cherioni complex (RS).—This mapping unit is on mountainsides and some low hills of the area. It occurs in several county and city parks. Slopes range from 5 to 90 percent. Areas are large and irregular in shape.

This mapping unit is mainly about 65 percent Rock outcrop and about 20 percent Cherioni soils, but in some areas is less than 50 percent Rock outcrop. The Cherioni soils have profiles similar to the one described as representative of the series, but in some areas are very cobbly or stony. Included in mapping are areas of Gachado soils, which make up about 5 to 10 percent of the unit.

This mapping unit has few uses. The lower slopes are occasionally grazed following seasonal rains (fig. 8). Rock outcrop in capability subclass VIII dryland. Cherioni soil in capability subclass VIIe dryland; Loam Hills range site; horticultural group 7; wildlife habitat group 12 dryland.

Suncity Series

The Suncity series consists of well-drained soils that are shallow over an indurated, silica-lime cemented pan. These soils formed in valley fill material that was deposited on old alluvial fans and old stream terraces. The fill material was derived from granite, granite-gneiss, andesite, limestone, and basalt. Slopes are 0 to 3 percent. Elevations

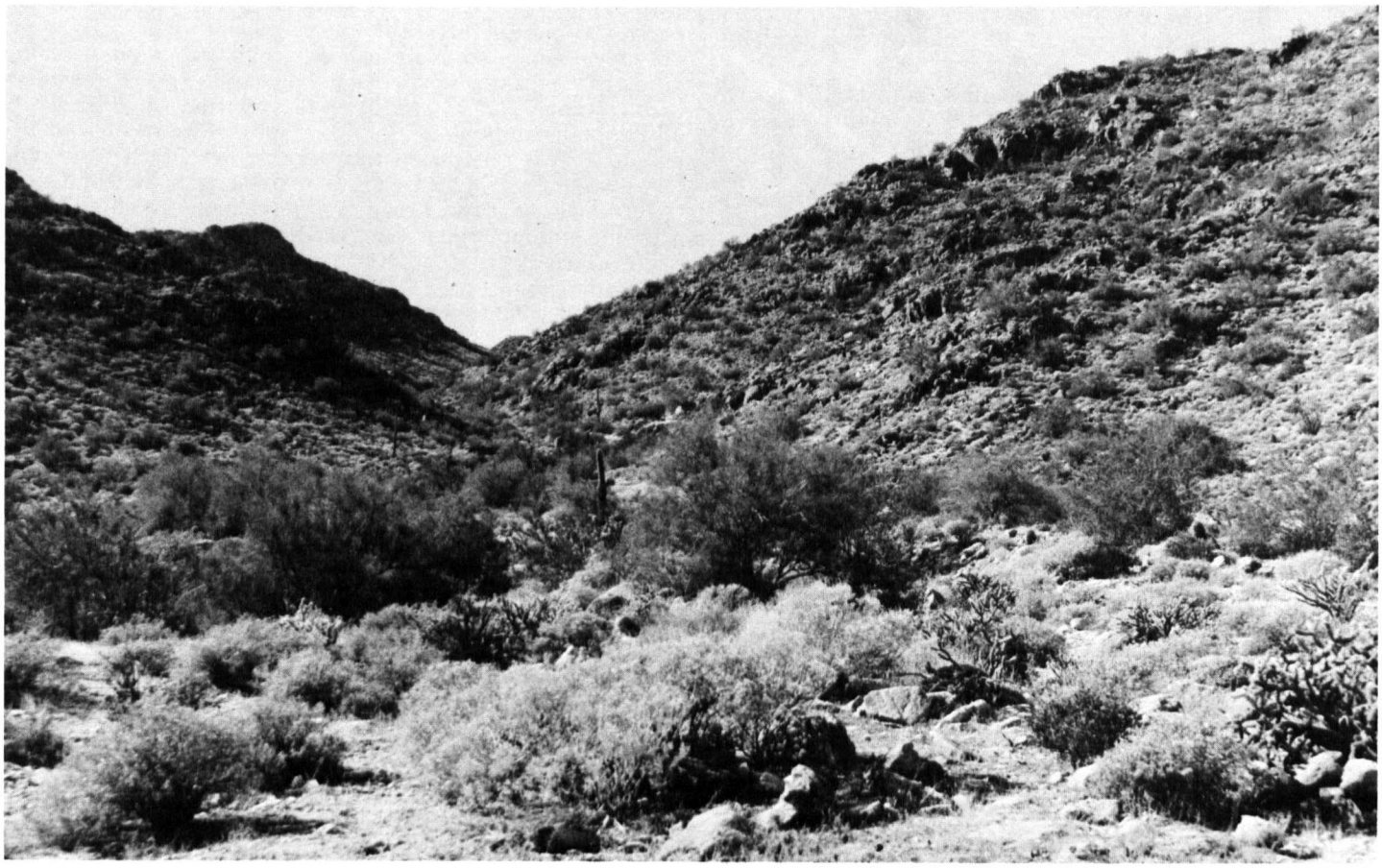

Figure 8.—**Loam Hills range site in poor condition on Rock outcrop-Cherioni complex.**

are 1,050 to 1,400 feet. The native vegetation is creosotebush, bursage, cactus, annual weeds and grasses, and scattered mesquite, paloverde, and ironwood trees. The average annual railfall is about 6 to 8 inches, the mean annual air temperature is 69° to 74° F, and the frost-free season is 270 to 320 days.

In a representative profile the surface is light yellowish-brown and light brown very gravelly loam and loam about 3 inches thick. The subsoil is brown and reddish-brown loam and clay loam about 10 inches thick. It is underlain by a pinkish-white indurated pan. The soil is moderately alkaline and weakly saline to strongly saline. It is generally calcareous throughout.

Permeability is moderately slow in the subsoil, and the pan is impermeable. Runoff is slow, and the erosion hazard is slight. The available water capacity is about 2 to 3 inches. Roots penetrate to a depth of less than 20 inches.

Suncity soils are used for range and wildlife. A few areas are used as homesites.

The Suncity soils in Maricopa County are mapped only with Pinal soils.

Representative profile of Suncity gravelly loam, in an area of Pinal-Suncity complex, 0 to 3 percent slopes, 1,300 feet east and 140 feet north of southwest corner of NW¼ of sec. 13, T. 4 N., R. 1 W. in an uncultivated area north of Sun City:

A2—0 to 1 inch, light yellowish-brown (10YR 6/4) and light-brown (7.5YR 6/4) very gravelly loam, dark yellowish brown (10YR 4/4) and dark brown (7.5YR 4/4) when moist; weak, thin, platy structure; slightly hard when dry, very friable when moist, slightly sticky and plastic when wet; common fine roots; many fine, medium, and coarse vesicular pores; 80 percent semi-angular gravel; noneffervescent; moderately alkaline; abrupt, smooth boundary.

A&B—1 to 3 inches, light-brown (7.5YR 6/4) loam and tongues of pink (7.5YR 7/4) very gravelly loam from A2 horizon, brown (7.5YR 5/4) when moist; weak, medium, platy structure; slightly hard when dry, very friable when moist, slightly sticky and plastic when wet; common fine roots, many fine and medium vesicular and few fine tubular pores; 10 percent semi-angular gravel; strongly effervescent; moderately alkaline; abrupt, irregular boundary.

B1tca—3 to 6 inches, brown (7.5YR 5/4) heavy loam, reddish brown (5YR 4/4) moist; weak, very fine, subangular blocky structure; slightly hard when dry, very friable when moist, slightly sticky and plastic when wet; common fine roots; many fine interstitial pores; thin patchy clay films on peds; 5 percent semiangular gravel; strongly effervescent; moderately alkaline; abrupt, smooth boundary.

B2tca—6 to 10 inches, reddish-brown (5YR 4/4) and yellowish-red (5YR 4/6) clay loam, reddish brown (5YR 4/3) when moist; moderate, fine, subangular blocky structure; slightly hard when dry, very friable when moist, slightly sticky and plastic when wet; few fine roots; few fine tubular and common fine interstitial pores; thin patchy clay films on peds; violently effervescent; common, fine, pinkish-white (7.5YR 8/2), irregularly shaped, soft lime masses and lime filaments; moderately alkaline; abrupt, smooth boundary.

B3tca—10 to 13 inches, reddish-brown (5YR 4/4) and yellowish-red (5YR 4/6) very gravelly clay loam, reddish brown (5YR 4/3) when moist; 40 percent angular pan fragments, 1 to 3 inches in diameter, and 20 percent sub-angular gravel.

Csicam—13 to 14 inches, pinkish-white (7.5YR 8/2) and pink (7.5YR 8/4 and 5YR 8/3), indurated, silica-lime cemented duripan with a thin laminar layer on the surface; massive; violently effervescent.

The A horizon is either an A2 horizon or A1 horizon or both. It has hue of 7.5YR and 10YR, value of 5 to 7 dry and 3 or 4 moist, and chroma of 4 to 6 dry and moist. It is sandy loam, very fine sandy loam, loam, gravelly very fine sandy loam, gravelly loam, very gravelly very fine sandy loam, or very gravelly loam. The B horizon has hue of 7.5YR and 5YR, value of 4 or 5 dry and 3 or 4 moist, and chroma of 4 to 6 dry and moist. It is clay loam or gravelly clay loam. The coarse fragment content averages less than 35 percent. The B horizon ranges from slightly to strongly saline. Lime filaments and soft masses or both occur throughout the B horizon in some places, but only in the lower part in others. In places the B3tca horizon contains pan fragments. The Csicam horizon is an indurated layer that ranges from 6 inches to 3 feet in thickness or it is several ½- to 3-inch indurated layers separated by softer material.

Toltec Series

The Toltec series consists of well-drained soils that are moderately deep over a weakly cemented to strongly cemented, silica-lime pan. Depth to the pan is about 28 inches. These soils formed in alluvium deposited on old stream terraces and alluvial fans. The alluvium was derived from a wide mixture of rock, including granite, limestone, andesite, schist, tuff, and rhyolite. Slopes are less than 1 percent. Elevations are 900 to 1,200 feet. In areas not cultivated, the vegetation is creosotebush, saltbush, mesquite trees, and annual weeds and grasses. The precipitation is 6 to 8 inches, the mean annual air temperature is 69° to 74° F, and the frost-free season is 250 to 300 days.

In a representative profile the soil is pale-brown and very pale brown loam to a depth of about 28 inches. It is underlain by a pinkish-gray, weakly cemented to strongly cemented, silica-lime pan that extends to a depth of 60 inches. The soil above the pan has a few segregations of lime and a few irregularly shaped silica-lime concretions. The soil is strongly effervescent to violently effervescent and moderately alkaline throughout. In places the pan consists of many weakly cemented plates ½ inch to 2 inches thick separated by soil material.

Permeability is moderate above the pan, and the pan is slowly permeable. Runoff is slow, and the erosion hazard is slight. The available water capacity is 6 to 8 inches. Roots penetrate to a depth of 20 to 40 inches.

Toltec soils are used for irrigated crops and range. Irrigated crops are cotton, alfalfa, barley, sugar beets, and sorghum. A few areas are used for homesites.

Representative profile of Toltec loam, 435 feet south and 200 feet west of northwest corner of NE¼ of sec. 4, T. 1 S., R. 2 E. in a cultivated field near Luke Air Force Base:

Ap—0 to 12 inches, pale-brown (10YR 6/3) loam, yellowish brown (10YR 5/4) when moist; massive; slightly hard when dry, friable when moist, slightly sticky and plastic when wet; common fine roots; few very fine tubular pores; few, fine, silica-lime cemented fragments; violently effervescent; moderately alkaline; abrupt, smooth boundary.

C1—12 to 20 inches, pale-brown (10YR 6/3) loam, yellowish brown (7.5YR 5/4) when moist; massive; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; common fine roots; many very fine tubular pores; few, white (10YR 8/2), silica-lime cemented fragments; violently effervescent; few, fine, white (10YR 8/2), lime mottles; moderately aklaline; abrupt, smooth boundary.

C2ca—20 to 28 inches, very pale brown (10YR 7/3) loam, dark brown (7.5YR 4/4) when moist; massive; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; common fine roots; many very fine tubular pores; common mica flakes;

strongly effervescent; few, medium and coarse, white (10YR 8/2), lime mottles; moderately alkaline; abrupt, irregular boundary.

C3sica—28 to 60 inches, pinkish-gray (7.5YR 7/2), strongly cemented, silica-lime duripan, light brown (7.5YR 6/4) when moist; massive; extremely hard; violently effervescent; moderately alkaline.

In most places the Ap and C1 horizons contain few to common, hard to extremely hard durinodes. Depth to the duripan, or C3sica horizon, ranges from 20 to 40 inches, but is generally 24 to 30 inches. In places the pan is one 6- to 32-inch, strongly cemented and imperivous layer. In other places it occurs as many 1- to 5-centimeter, weakly cemented plates separated by medium-textured to moderately fine textured material. Silica-lime cemented fragments and lime filaments occur throughout.

The Ap, C1, and C2ca horizons have hue of 7.5YR to 10YR, value of 5.5 to 7 dry and 4 or 5 moist, and chroma of 2 to 4 dry and moist. The A horizon is loam or very fine sandy loam. The C1 and C2 horizons are loam, very fine sandy loam, or fine sandy loam. In places the Cca and C3sica horizons contain iron and manganese stains. The Ap and C1 horizons are modately alkaline, and the Cca and C3sica horizons are moderately alkaline to strongly alkaline. In some areas the surface is covered with a thin salt crust.

Toltec loam (Ta).—This mapping unit occurs near Luke Air Force Base, in an area near Laveen and Wintersburg. The surface is convex. Slopes are less than 1 percent. Areas are oval in shape and 4 to 20 acres in size.

Included with this soil in mapping are small areas of Gilman loam, 0 to 1 percent slopes; Laveen loam, 0 to 1 percent slopes; and Tucson loam and some small areas of soils that have an indurated pan. Included soils do not exceed 10 percent of the mapping unit. Capability unit IIs–7 irrigated, subclass VIIs dryland; Loam Upland range site; horticultural group 7; wildlife habitat group 1 irrigated, 11 dryland.

Torrifluvents

Torrifluvents (TB) consists of young, unconsolidated, gravelly, cobbly, and stony alluvium. It is on young alluvial fans at the base of several mountain ranges where it is subject to frequent overflow. The surface is very undulating and dissected by many stream channels that have cut 3 to 25 feet below the surface. Slopes range from less than 1 percent to 5 percent. The steeper slopes are near the base of the mountains. Areas are long and narrow and about 200 acres in size.

Torrifluvents is highly stratified and varies widely in texture. It is 35 to 80 percent gravel, cobbles, and stones. The stony soils are near the mountains, and the gravelly soils are ¼ to 1 mile from the mountains. Included in mapping are a few areas of Antho and Ebon soils.

Torrifluvents is used for range. Capability subclass VIIe dryland; Loam Upland range site; horticultural group 4; wildlife habitat group 4 irrigated, 11 dryland.

Torriorthents

Torriorthents (Tc) is soil material that has been moved and used as fill. It is most extensive in and around the City of Phoenix. Areas range from 2 to 40 acres in size.

The fill material is unsmoothed, is 3 to 10 feet deep, and ranges from sandy loam to clay loam. It is as much as 70 percent gravel and cobbles in places. In a few areas it contains fragments of building material and trash. Several areas are old sanitary landfills that have been covered with 2 to 5 feet of fill material.

Several areas of Torriorthents in the city of Phoenix are used or are proposed as building sites. Capability subclass VIIs dryland.

Torripsamments and Torrifluvents, Frequently Flooded

Torripsamments and Torrifluvents, frequently flooded (TD), consists of soils formed in a variety of stratified sediment recently deposited by intermittent streams. It is mainly in long, narrow strips in the present channel of major streams. It is frequently flooded during intense summer storms. In most areas the surface is smooth, but in a few it is undulating as a result of blowing. Slopes are 0 to 3 percent. In many areas the boundaries of mapped areas change with varying streamflow.

Torripsamments and Torrifluvents, frequently flooded, contains almost no organic matter, except the organic matter contained when deposited. It is mainly sandy and is 5 to 80 percent gravel and cobbles. It is similar to Carrizo and Brios soils, but it supports little or no vegetation, is in a slightly lower position, and is subject to more frequent flooding.

Torripsamments and Torrifluvents, frequently flooded, is used as wildlife habitat. Capability subclass VIII dryland; horticultural group 4.

Tremant Series

The Tremant series consists of deep, well-drained soils. These soils formed in gravelly alluvium deposited as old alluvial fans and stream terraces. The alluvium was derived from mixed sources, but mainly from igneous rocks. Slopes are 0 to 5 percent, but are dominantly less than 1 percent. Elevations are 800 to 1,800 feet. The vegetation is creosotebush, bursage, cactus, and scattered paloverde and mesquite trees. The precipitation is 6 to 8 inches, the mean annual air temperature is 69° to 74° F, and the frost-free season is 270 to 320 days.

In a representative profile the surface layer is light-brown very gravelly loam about 1 inch thick. The subsoil is 35 inches thick. The upper 7 inches is reddish-brown clay loam, and the lower 28 inches is reddish-brown, yellowish-red, reddish-yellow, and pink gravelly clay loam. The underlying material is pink gravelly loam to a depth of 60 inches. The lower part of the subsoil and the underlying material contain large amounts of lime. The soil is moderately alkaline.

Permeability is moderately slow. Runoff is medium. The erosion hazard is slight to moderate depending upon slope. The available water capacity is 6 to 8 inches. Roots penetrate to a depth of more than 60 inches.

Tremant soils are used for irrigated crops, range, recreation, and wildlife. Irrigated crops are cotton, alfalfa, barley, safflower, sugar beets, sorghum, citrus, and grapes. A few areas are used for homesites and industry.

Representative profile of Tremant gravelly clay loam, 1,250 feet west and 1,120 feet south of the northeast corner of sec. 23, T. 4 N., R. 2 W. in an uncultivated area near Beardsley:

A1—0 to 1 inch, light-brown (7.5YR 6/4) very gravelly loam, brown (7.5YR 5/4) when moist; weak, medium, platy structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; many fine roots; few fine tubular and common fine vesicular

pores; 50 percent subangular gravel; noneffervescent; moderately alkaline; abrupt, smooth boundary.

B21t—1 to 8 inches, reddish-brown (5YR 5/4) clay loam, reddish brown (5YR 4/4) when moist; weak, very fine, subangular blocky structure; slightly hard when dry, very friable when moist, sticky and plastic when wet; many fine roots; few fine and medium tubular pores; few thin clay films on peds; 5 percent gravel; slightly effervescent; moderately alkaline; abrupt, smooth boundary.

B22tca—8 to 14 inches, reddish-brown (5YR 5/4) gravelly clay loam, reddish brown (5YR 4/4) when moist; weak, fine, subangular blocky structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; many fine interstitial pores; common thin clay films on peds and in pores; 15 to 20 percent gravel; violently effervescent; many, fine, pinkish-white (5YR 8/2) lime filaments; moderately alkaline; clear, smooth boundary.

B23tca—14 to 23 inches, yellowish-red (5YR 5/8) and pink (7.5YR 7/4) gravelly clay loam, reddish brown (5YR 4/4) and reddish yellow (7.5YR 6/6) when moist; weak, fine, subangular blocky structure; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; few fine roots; few medium interstitial and very few fine tubular pores; few thin clay films on peds and in pores; 35 percent gravel; violently effervescent; many, coarse, pinkish-white (5YR 8/2) lime segregations, soft lime masses, and common fine and medium nodules of lime; moderately alkaline; clear, wavy boundary.

B3ca—23 to 36 inches, reddish-yellow (7.5YR 7/6) and pink (5YR 7/4) gravelly loam, strong brown (7.5YR 5/6) when moist; massive; very hard when dry, firm when moist, slightly sticky and slightly plastic when wet; very few fine tubular pores; very few thin clay films in pores; 25 percent gravel; violently effervescent; many coarse, pinkish-white (5YR 8/2), soft lime masses; moderately alkaline; clear, smooth boundary.

Cca—36 to 60 inches, pink (7.5YR 7/4) gravelly loam, light brown (7.5YR 6/4) when moist; massive; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; common fine tubular and few fine interstitial pores; 35 percent gravel; violently effervescent; many, coarse, pinkish-white (7.5YR 8/2) lime spots, soft lime masses, and lime concretions; moderately alkaline.

A desert pavement covers about 65 percent of the surface. The solum ranges from 12 to 48 inches in thickness. Depth to a horizon that is 15 percent or more calcium carbonate equivalent ranges from 14 to 30 inches. The calcium carbonate equivalent below this depth ranges from 15 to 60 percent. The mean annual soil temperature ranges from 72° to 80° F. The soil is generally dry between depths of 7 to 20 inches and is dry to a depth of 12 inches more than half the time the soil temperature is more than 41° F. The soil between depths of 10 and 40 inches is 15 to 35 percent coarse fragments. The coarse fragments are mainly gravel, but in places are as much as 15 percent cobbles. The solum ranges from mildly alkaline to strongly alkaline.

The A horizon has hue of 5YR to 10YR, value of 5 to 7 dry and 3 to 5 moist, and chroma of 2 to 4. It is very gravelly loam, gravelly loam, loam, gravelly clay loam, clay loam, or gravelly sandy loam. A thin, discontinuous A2 horizon and a thin B1 horizon occur in some areas. The B horizon has hue of 5YR or 7.5YR, value of 4 to 6 dry and 3 to 5 moist, and chroma of 3 to 5. It is gravelly clay loam, gravelly sandy clay loam, or gravelly heavy loam. It is generally 15 to 35 percent coarse fragments, but the content of gravel varies. The B2t horizon ranges from weak to moderate, fine to medium, subangular blocky and is weak, prismatic in places. The C horizon has hue of 5YR or 7.5YR, value of 5 to 8 dry and 4 to 6 moist, and chroma of 3 to 6. It is gravelly loam, gravelly clay loam, gravelly sandy loam, loam, or sandy loam to a depth of 40 inches or more. Strata of sand and gravel are common at a depth of more than 40 inches. The C horizon is weakly cemented in places.

Tremant loam (Te).—This nearly level soil is on old alluvial fans and stream terraces. The surface is slightly convex. In areas not cultivated, it is dissected by shallow stream channels at 100- to 300-foot intervals. Slopes are less than 1 percent. Areas are long and narrow and about 15 acres in size.

This soil has a profile similar to the one described as representative of the series, but the surface layer is 8 to 12 inches thick and is relatively free of gravel.

Included with this soil in mapping are small areas of Rillito loam, 0 to 1 percent slopes; Laveen loam, 0 to 1 percent slopes; and Mohall loam. The total extent of all included soils seldom exceeds 15 percent.

This Tremant soil is used for cotton, alfalfa, sorghum, barley, grapes, safflower, and citrus. It is also used for range. A few areas are used as homesites. Capability unit IIs–7 irrigated, subclass VIIs dryland; Loam Upland range site; horticultural group 2; wildlife habitat group 1 irrigated, 11 dryland.

Tremant gravelly loam, 0 to 1 percent slopes (TfA).—This nearly level soil is on old alluvial fans and stream terraces, mainly in the northern part of the Salt River Valley. Slopes are less than 1 percent. Areas are long and narrow and about 15 acres in size.

This soil has a profile similar to the one described as representative of the series, but the surface layer is gravelly loam 5 to 12 inches thick, the subsoil is gravelly loam, and the underlying material is gravelly sandy loam.

Included with this soil in mapping are small areas of Tremant gravelly sandy loam, 0 to 1 percent slopes; Laveen loam, 0 to 1 percent slopes; Rillito gravelly loam, 0 to 1 percent slopes; Mohall loam; and Harqua gravelly clay loam. The total extent of all included soils seldom exceeds 15 percent.

This Tremant soil is used mainly for range. A few areas are used for cotton, barley, citrus, and alfalfa. Capability unit IIs–6 irrigated, subclass VIIs dryland; Loam Upland range site; horticultural group 2; wildlife habitat group 1 irrigated, 11 dryland.

Tremant gravelly loam, 1 to 3 percent slopes (TfB).—This gently sloping soil is an old alluvial fans and stream terraces, mainly in the northern part of the Salt River Valley. Slopes are mainly 1 to 3 percent, but a few short side slopes are nearly 5 percent. The erosion hazard is moderate. Areas are long and narrow and about 14 acres in size.

This soil has a profile similar to the one described as representative of the series, but the surface layer is gravelly loam 5 to 12 inches thick. Included in mapping are small areas of Harqua gravelly clay loam, 1 to 3 percent slopes; Rillito loam, 0 to 1 percent slopes; Gunsight gravelly loam, 0 to 1 percent slopes; and Laveen loam, 0 to 1 percent slopes. The total extent of all included soils seldom exceeds 15 percent.

This soil is used for range. Only a small acreage is cultivated. A few areas are used as homesites. Capability unit IIe–6 irrigated, subclass VIIe dryland; Loam Upland range site; horticultural group 2; wildlife habitat group 1 irrigated, 11 dryland.

Tremant clay loam (Tg).—This nearly level soil is on old alluvial fans and stream terraces, mainly in the northern part of the Salt River Valley. The surface is slightly convex. In areas not cultivated it is dissected by shallow stream channels at 100- to 500-foot intervals. Slopes are less than 1 percent. Areas are long and narrow and about 8 acres in size.

The profile of this soil is similar to the one described as representative of the series, but the surface layer is clay loam 6 to 12 inches thick and is relatively free of

gravel. Included in mapping are small areas of Mohall clay loam; Vecont clay; Laveen loam, 0 to 1 percent slopes; Harqua gravelly clay loam, 0 to 1 percent slopes; and Rillito loam, 0 to 1 percent slopes. The total extent of all included soils seldom exceeds 15 percent.

This soil is used for irrigated crops and range. Irrigated crops are cotton, alfalfa, barley, sorghum, sugar beets, citrus, grapes, and safflower. A few areas are used as homesites. Capability unit IIs–7 irrigated, subclass VIIs dryland; Loam Upland range site; horticultural group 2; wildlife habitat group 1 irrigated, 11 dryland.

Tremant gravelly clay loam (Th).—This nearly level soil is on old alluvial fans and terraces, mainly in the northern part of the Salt River Valley. The surface is slightly convex. It is dissected by shallow stream channels at 100- to 400-foot intervals. Slopes are generally less than 1 percent, but a few short side slopes are nearly 2 percent. Areas are long and narrow and average about 12 acres in size.

The profile of this soil is the one described as representative of the series. Included in mapping are a few small areas of Rillito loam, 0 to 1 percent slopes; Mohall clay loam; Laveen loam, 0 to 1 percent slopes; Pinamt gravelly clay loam, 0 to 1 percent slopes; and Harqua gravelly clay loam, 0 to 1 percent slopes. The total extent of all included soils seldom exceeds 15 percent.

This Tremant soil is used for range. The only acreages cultivated are those in fields of better soils. Irrigated crops are cotton, alfalfa, barley, citrus, and sorghums. A few areas are used as homesites. Capability unit IIs–6 irrigated, subclass VIIs dryland; Loam Upland range site; horticultural group 2; wildlife habitat group 1 irrigated, 11 dryland.

Tremant complex, 0 to 3 percent slopes (TPB).—This nearly level to gently sloping mapping unit is on stream terraces that parallel the Agua Fria River in the northern part of the Salt River Valley. The surface is slightly convex. It is dissected by shallow stream channels at 100- to 300-foot intervals. Slopes are generally less than 1 percent, but a few short side slopes are nearly 3 percent. Areas are long and narrow and range from 50 to 400 acres in size.

This mapping unit is about 40 percent Tremant gravelly clay loam and 40 percent Tremant loam. The Tremant gravelly clay loam is on slightly higher positions that are 80 to 90 percent covered with a varnished desert pavement of gravel and cobbles. The Tremant loam is in slightly concave depressions. It has a profile similar to the one described as representative of the series, but the surface layer is 4 to 12 inches thick.

Included with this unit in mapping are small areas of Mohall loam; Estrella loam; Pinamt gravelly loam; Laveen loam, 0 to 1 percent slopes; and Gilman loam, 0 to 1 percent slopes. In most areas included soils make up about 20 percent of the unit. Several mapped areas north of Beardsley are as much as 20 percent Antho gravelly sandy loam. This soil occurs as slight ridges that meander throughout those areas.

This mapping unit is used for range. It is not cultivated. Capability subclass VIIs dryland; Loam Upland range site; horticultural group 2; wildlife habitat group 11 dryland.

Tremant-Rillito complex, 0 to 1 percent slopes (TrA).—This nearly level mapping unit is on old alluvial fans and stream terraces. It occurs throughout the survey area, but is most extensive in the northern part of the Salt River Valley. It is dissected by shallow stream channels at 50- to 300-foot intervals. Slopes are generally less than 1 percent, but a few short side slopes are as much as 2 percent. Areas are long and narrow and range from 12 to 200 acres in size.

This mapping unit is about 40 percent Tremant gravelly clay loam, 25 percent a Rillito gravelly loam that has 0 to 1 percent slopes, and 20 percent a Gunsight gravelly loam that has 0 to 1 percent slopes. These soils have profiles similar to the ones described as representative of their respective series, but the Rillito soil has a surface layer of gravelly loam. The Tremant soil is in small, oval-shaped areas that are about 200 feet in diameter and are in the center of alluvial fans surrounded by Rillito soils. The Tremant soil is nearly covered with a varnished gravelly desert pavement and the Gunsight and Rillito soils are 30 to 70 percent covered with an unvarnished gravel. Rodent burrows are numerous in the areas of Rillito soils.

Included with this unit in mapping are small areas of Laveen loam, 0 to 1 percent slopes; Harqua gravelly clay loam, 0 to 1 percent slopes; and Perryville gravelly loam, 0 to 1 percent slopes. Included soils make up about 15 percent of the unit.

This mapping unit is used for range. The only acreages cultivated are those in fields of better soils. A few areas are used as homesites and feedlots. Capability unit IIs–6 irrigated, subclass VIIs dryland. Tremant soil in Loam Upland range site; horticultural group 2; wildlife habitat group 1 irrigated, 11 dryland. Rillito soil in Loam Upland range site; horticultural group 6; wildlife habitat group 2 irrigated, 11 dryland.

Tremant-Rillito complex, 1 to 3 percent slopes (TrB).—This gently sloping mapping unit is on ridges of old alluvial fans. It occurs throughout the survey area, but is most extensive in the northern part of the Salt River Valley. It is dissected by intermittent stream channels, 1 to 10 feet deep, at 50- to 300-foot intervals. Slopes are generally about 1 to 2 percent, but a few short side slopes are nearly 5 percent. The erosion hazard is moderate. Areas are long and narrow and about 10 to 25 acres in size.

This mapping unit is about 35 percent Tremant gravelly clay loam, 30 percent a Rillito gravelly loam that has 1 to 3 percent slopes, and 25 percent a Gunsight gravelly loam that has 1 to 3 percent slopes. These soils have profiles similar to the ones described as representative of their respective series, but the Rillito soil has a surface layer of gravelly loam. The Tremant soil is in small, oval-shaped areas that are about 200 feet in diameter, are near the center of alluvial fans, and are surrounded by Rillito and Gunsight soils. The Tremant soil is 80 to 90 percent covered with a varnished, gravelly desert pavement, and the Gunsight and Rillito soils are 30 to 70 percent covered with unvarnished gravel. Rodent burrows are numerous in the areas of Gunsight and Rillito soils.

Included with this unit in mapping are small areas of Laveen loam, 1 to 3 percent slopes; Coolidge gravelly sandy loam, 1 to 3 percent slopes; Perryville gravelly loam, 1 to 3 percent slopes; and a Harqua gravelly clay loam that has slopes of 0 to 1 percent. Included soils make up about 10 percent of the unit.

This mapping unit is used for range. It is not cultivated. Capability subclass VIIe dryland. Tremant soil in Loam Upland range site; horticultural group 2; wildlife habitat

group 1 irrigated, 11 dryland. Rillito soil in Loam Upland range site; horticultural group 6; wildlife habitat group 2 irrigated, 11 dryland.

Tremant-Rillito complex, 0 to 5 percent slopes (TSC).—This nearly level to sloping mapping unit is on old alluvial fans. It is dissected by intermittent stream channels at 100- to 300-foot intervals. The channels have cut 1 foot to 15 feet below the surface. Slopes are generally less than 1 percent, but many short side slopes are as much as 5 percent. The erosion hazard is moderate. Areas are long and narrow and about 100 acres in size.

This mapping unit is about 35 percent Tremant gravelly clay loam, 30 percent a Rillito gravelly loam that has 0 to 3 percent slopes, and 20 percent a Gunsight gravelly loam that has 0 to 5 percent slopes. These soils have profiles similar to the ones described as representative of their respective series, but the Rillito soil has a surface layer of gravelly loam and slopes of more than 1 percent. The Tremant soil is in oval-shaped areas that are about 200 feet in diameter and are near the center of alluvial fans. It is 80 to 90 percent covered with a varnished desert pavement of gravel and a few cobbles. The Rillito soil is on concave side slopes near the center of a few alluvial fans. The Gunsight soil is on the steeper, concave sides of alluvial fans. The Gunsight and Rillito soils are 40 to 60 percent covered with unvarnished gravel.

Included with this unit in mapping are a few areas of Carrizo gravelly sandy loam; Laveen sandy loam; Coolidge gravelly sandy loam, 1 to 3 percent slopes; and Perryville gravelly loam, 0 to 1 percent slopes. Included soils make up no more than 15 percent of the unit.

This mapping unit is used for range. It is not cultivated. A few areas are used as homesites. Capability subclass VIIs dryland. Tremant soil in Loam Upland range site; horticultural group 2; wildlife habitat group 11 dryland. Rillito soil and Gunsight soil in Loam Upland range site; horticultural group 6; wildlife habitat group 11 dryland.

Trix Series

The Trix series consists of deep, well-drained soils. These soils formed in 20 to 40 inches of recent alluvium that was deposited over an older surface on valley plains and low terraces. The alluvium was derived from granite, schist, rhyolite, and some material from basic igneous rocks. Slopes are less than 1 percent. Elevations range from 900 to 1,300 feet. In areas not cultivated the vegetation is creosotebush, cactus, annual weeds and grasses, and scattered mesquite and paloverde trees. Precipitation is 6 to 8 inches, the mean annual air temperature is 69° to 74° F, and the frost-free season is 250 to 300 days.

In a representative profile the surface layer is brown clay loam about 10 inches thick. The underlying material is light-brown clay loam to a depth of 30 inches. Below this to a depth of 65 inches is an old buried soil of brown sandy clay loam and clay loam. The lower part of the soil contains visible amounts of lime. The soil is moderately alkaline and strongly to violently effervescent.

Permeability is moderately slow. Runoff is slow, and the erosion hazard is slight. The available water capacity is 11 to 13 inches. Roots penetrate to a depth of 5 feet or more.

Trix soils are used for cotton, alfalfa, sorghum, barley, sugar beets, safflower, citrus, wheat, and truck crops. Parts of the cities of Phoenix and Glendale are on these soils.

Representative profile of Trix clay loam, 17 feet east and 34 feet south of northwest corner of NE¼ of sec. 22; T. 2 N., R. 1 E. in a cultivated field west of Glendale:

Ap—0 to 10 inches, brown (7.5YR 5/4) clay loam, dark brown (7.5 YR 4/4) when moist; massive; hard when dry, firm when moist, sticky and plastic when wet; common fine and very fine roots; few fine tubular pores; strongly effervescent; moderately alkaline; abrupt, smooth boundary.

C1—10 to 30 inches, light-brown (7.5YR 6/4) clay loam, dark brown (7.5YR 4/4) when moist; massive; very hard when dry, firm when moist, sticky and plastic when wet; common fine and very fine roots; many very fine and few fine tubular pores; violently effervescent; few, fine, faint filaments of lime; moderately alkaline; abrupt, smooth boundary.

B1tb—30 to 34 inches, brown (7.5YR 5/4) sandy clay loam, dark brown (7.5YR 4/4) when moist; massive; hard when dry, friable when moist, sticky and plastic when wet; common fine and very fine roots; common very fine and few fine tubular pores; few thin clay films in pores; common fine gravel; strongly effervescent; few fine filaments of lime; moderately alkaline; gradual, smooth boundary.

B2tb—34 to 49 inches, brown (7.5YR 5/4) clay loam, dark brown (7.5YR 4/4) when moist; moderate, fine and medium, subangular blocky structure; very hard when dry, firm when moist, sticky and plastic when wet; common fine and very fine roots; few fine tubular pores; common thin clay films on peds and in pores; strongly effervescent; common faint filaments of lime; moderately alkaline; clear, wavy boundary.

B3cab—49 to 65 inches, brown (7.5YR 5/4) and light brown (7.5YR 6/4) clay loam, dark brown (7.5YR 4/4) when moist; weak, medium, subangular blocky structure; hard when dry, friable when moist, sticky and plastic when wet; common fine and very fine roots; many fine tubular pores; violently effervescent; few, fine and medium, distinct, pinkish-white (7.5YR 8/2) filaments and segregations of lime, pinkish gray (7.5YR 7/2) when moist; moderately alkaline.

The soil ranges from slightly to strongly effervescent. Depth to the buried B horizon ranges from 20 to 39 inches, but is commonly 30 inches.

The A horizon has hue of 10YR and 7.5YR and value of 5 or 6 dry and 3 or 4 moist. It is dominantly clay loam, but is silty clay loam in places. This horizon is weak, fine, granular, or it is massive.

The C1 horizon has hue of 10YR and 7.5YR, value of 4 to 6 dry and 3 to 5 moist, and chroma of 2 to 4 dry and moist. It is heavy loam, clay loam, and silty clay loam. The buried Bt horizon has hue of 7.5YR and 5YR, value of 5 or 6 dry and 4 or 5 moist, and chroma of 3 to 6 dry and moist. It is heavy loam, clay loam, and sandy clay loam and ranges from weak to moderate subangular blocky. A loam Cca horizon that contains many lime segregations and masses is within a depth of 60 inches in many places.

Trix clay loam (Tt).—This soil is mainly in the Salt River Valley and is most extensive near Glendale. Slopes are generally slightly concave and less than 1 percent. Areas are generally more than 40 acres in size.

Included with this soil in mapping are a few small areas of Avondale clay loam, Glenbar clay loam, Mohall clay loam, and Laveen clay loam. Included soils make up about 12 percent of the mapping unit.

All the acreage of this Trix soil is cultivated, except those areas covered with buildings. Capability unit I–1 irrigated, subclass VIIc dryland; Loam Upland range site; horticultural group 1; wildlife habitat group 1 irrigated, 11 dryland.

Tucson Series

The Tucson series consists of deep, well-drained soils that have large amounts of lime near the surface. These soils formed on old alluvial fans and valley plains paralleling major stream channels. The alluvium was derived from a wide variety of rocks, including granite, rhyolite, andesite, and some limestone and basalt. Slopes are less than 1 percent. Elevations are from 800 to 1,400 feet. The native vegetation is creosotebush, bursage, and scattered mesquite and paloverde trees. The average annual rainfall is 6 to 8 inches, the mean annual air temperature is 68° to 74° F, and the frost-free season is 250 to 290 days.

In a representative profile the surface layer is light-brown loam about 14 inches thick. The subsoil is yellowish-red clay loam about 22 inches thick. The underlying material is light-brown loam to a depth of 65 inches or more. The subsoil and underlying material contain large concentrations of lime. The soil is moderately alkaline throughout.

Permeability is moderately slow. Runoff is medium, and the erosion hazard is slight. The available water capacity is 11 to 12 inches. Roots penetrate to a depth of 60 inches or more.

Tucson soils are used for irrigated crops and range. Irrigated crops are cotton, alfalfa, small grains, sugar beets, safflower, grapes, citrus, sorghums, and vegetables. A few areas are used as homesites.

Representative profile of Tucson loam, 2,260 feet north and 110 feet east of southwest corner of sec. 32, T. 2 N., R. 8 W. in a cultivated field in the Harquahala Valley:

Ap—0 to 14 inches, light-brown (7.5YR 6/4) heavy loam, reddish brown (5YR 4/4) when moist; massive; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; many fine and medium roots; few very fine tubular pores; few fine gravel; violently effervescent; moderately alkaline; clear, smooth boundary.

B21tca—14 to 20 inches, yellowish-red (5YR 5/6) clay loam, yellowish red (5YR 4/6) when moist; weak to moderate, fine and medium, subangular blocky structure; very hard when dry, friable when moist, slightly sticky and plastic when wet; many very fine and fine roots; common fine tubular pores; few thin clay films on peds; few fine gravel; few, very fine, black (10YR 2/1) stains on peds; violently effervescent; common, fine and medium, pinkish-white (7.5YR 8/2) and white (5YR 8/1), irregularly shaped, soft lime masses and common fine lime filaments, pink (7.5YR 8/4) when moist; moderately alkaline; clear, smooth boundary.

B22tca—20 to 31 inches, yellowish-red (5YR 4/6) clay loam, yellowish red (5YR 4/8) when moist; moderate, fine and medium, subangular blocky structure; very hard when dry, friable when moist, sticky and plastic when wet; common very fine and fine roots; many fine and medium tubular pores; few thin clay films on peds and in pores; few, very fine, black (10YR 2/1) stains on peds; violently effervescent; many, fine and medium, pinkish-white (7.5YR 8/2), irregularly shaped, soft lime masses and common fine lime filaments, pink (7.5YR 8/4) when moist; moderately alkaline; clear, wavy boundary.

B3tca—31 to 36 inches, yellowish-red (5YR 5/6) clay loam, reddish brown (5YR 4/4) when moist; weak, medium and coarse, subangular blocky structure; hard when dry, friable when moist, sticky and plastic when wet; common very fine and fine roots; many fine and medium tubular pores; few thin clay films in pores; few fine medium and coarse gravel; few, medium, black (10YR 2/1) stains on peds; violently effervescent; common, fine, pinkish-white (7.5YR 8/2), irregularly shaped and rounded, soft lime masses, pinkish white (7.5YR 8/2) when moist; moderately alkaline; clear, smooth boundary.

Cca—36 to 65 inches, light-brown (7.5YR 6/4) heavy loam, dark brown (7.5YR 4/4) when moist; weak, medium and coarse, subangular blocky structure; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; common fine roots; few very fine and fine tubular pores; few fine, medium, and coarse gravel; few, medium, black (10YR 2/1) stains on faces of peds; few, medium and coarse, pinkish-white (7.5YR 8/2) gypsum crystals; violently effervescent; common, fine, pinkish-white (7.5YR 8/2), irregularly shaped and rounded, soft lime masses and common fine lime filaments, pinkish white (7.5YR 8/2) when moist; moderately alkaline.

The solum ranges from 20 to 55 inches or more in thickness. Depth to the zone of lime accumulation ranges from 6 to 16 inches. The soil is calcareous throughout. Reaction is generally moderately alkaline and is strongly alkaline in the lower part of the C horizon. The soil is generally dry unless irrigated, but is moist in some areas during summer, mainly July and August. The mean annual soil temperature at a depth of 20 inches is 72° to 80° F. The content of coarse fragments between depths of 10 and 40 inches is less than 15 percent.

The A horizon has hue of 10YR to 5YR, value of 5 to 7 dry and 4 or 5 moist, and chroma of 2 through 4. It is loam, clay loam, and sandy clay loam. The B2t horizon has hue of 7.5YR or 5YR, value of 4 to 6 dry and 3 to 5 moist, and chroma of 4 to 8. The B3 horizon is clay loam, sandy clay loam, and heavy loam. It ranges from weak or moderate, fine to coarse, subangular and angular blocky. In places the B3tca and Cca horizons are weakly lime cemented or contain a few durinodes (less than 10 percent). The Cca horizon is heavy loam, sandy loam, sandy clay loam, or light clay loam. In places black stains are on ped faces in the lower part of the soil.

Tucson loam (Tu).—This nearly level soil is on old alluvial fans and valley plains that parallel the major streams. It occurs throughout the survey area. Slopes are slightly concave and generally less than 1 percent. Areas are generally somewhat oval in shape and about 25 acres in size.

This soil has the profile described as representative of the series. Included in mapping are small areas of Casa Grande loam; Laveen loam, 0 to 1 percent slopes; Gilman loam, 0 to 1 percent slopes; Estrella loam; and Tremant loam. Included soils make up about 15 percent of the unit.

This Tucson soil is used for cotton, alfalfa, small grain, vegetables, sugar beets, and safflower. Some areas are used for range. Part of the city of Phoenix is on this soil. Capability unit I–1 irrigated, subclass VIIc dryland; Loam Upland range site; horticultural group 2; wildlife habitat group 1 irrigated, 11 dryland.

Tucson clay loam (Tw).—This nearly level soil is on old alluvial fans and valley plains that parallel major streams. It occurs throughout the survey area. Slopes are generally concave and less than 1 percent. Areas are generally somewhat oval in shape and about 20 acres in size.

This soil has a profile similar to the one described as representative of the series, but the surface layer is clay loam 8 to 14 inches thick. Included in mapping are small areas of Casa Grande loam; Mohall clay loam; Laveen loam, 0 to 1 percent slopes; Gilman loam, 0 to 1 percent slopes; and Estrella loam. Included soils make up about 18 percent of the mapping unit. Some mapped areas south of Tolleson are about 3 percent Toltec loam.

This soil is used for cotton, alfalfa, small grain, sorghums, sugar beets, truck crops, grapes, safflower, and citrus. A few areas are used for range. Parts of the cities of Phoenix, Peoria, and Glendale are on this soil. Capa-

bility unit I–1 irrigated, subclass VIIc dryland; Loam Upland range site; horticultural group 2; wildlife habitat group 1 irrigated, 11 dryland.

Valencia Series

The Valencia series consists of deep, well-drained soils. These soils formed in 20 to 40 inches of recent alluvium that was deposited over an older surface on valley plains and alluvial fans. The recent alluvium and the older, underlying alluvium both were derived from acid and basic igneous rocks and some shale and limestone. Slopes are 0 to 1 percent. Elevations are 800 to 1,400 feet. The natural vegetation is creosotebush, annual weeds, and grasses, cactus, and scattered mesquite and paloverde trees. The average annual rainfall is 6 to 8 inches, the mean annual air temperature is 69° to 74° F, and the frost-free season is 250 to 300 days.

In a representative profile the surface layer is brown sandy loam about 10 inches thick. The underlying material is light-brown sandy loam to a depth of 26 inches. Below this is older, buried light-brown and brown clay loam and sandy clay loam to a depth of 60 inches or more. The upper part of the soil is weakly effervescent to strongly effervescent, and the lower part is strongly effervescent to violently effervescent. The soil is generally moderately alkaline, but in some areas the lower part is strongly alkaline to very strongly alkaline.

Permeability is moderately rapid in the upper part of the soil and moderately slow in the lower part. Runoff is slow, and the erosion hazard is slight. Roots penetrate to a depth of 60 inches or more.

Valencia soils are used for irrigated crops, recreation, range, and wildlife. Irrigated crops are cotton, alfalfa, small grains, grapes, sorghum, citrus, sugar beets, safflower, and truck crops. Part of the city of Phoenix is on these soils. Some areas are used as homesites.

Representative profile of Valencia sandy loam, 580 feet north and 340 feet west of southeast corner of sec. 20, T. 2 S., R. 1 W. in a cultivated field in the Rainbow Valley:

Ap—0 to 10 inches, brown (7.5YR 5/4) sandy loam, dark brown (7.5YR 4/4) when moist; massive; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; few fine roots; many fine interstitial pores; slightly effervescent; moderately alkaline; abrupt, smooth boundary.

C1—10 to 22 inches, light-brown (7.5YR 6/4) sandy loam, dark brown (7.5YR 4/4) when moist; massive; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; few fine roots; few very fine tubular pores; strongly effervescent; few, fine, faint, pinkish-white (7.5YR 8/2) filaments of lime; moderately alkaline; abrupt, smooth boundary.

C2—22 to 26 inches, light-brown (7.5YR 6/4) sandy loam, dark brown (7.5YR 4/4) when moist; massive; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; few fine roots; common very fine tubular pores; strongly effervescent; moderately alkaline; clear, smooth boundary.

IIB21tcab—26 to 31 inches, light-brown (7.5YR 6/4) light sandy clay loam, reddish brown (5YR 4/4) when moist; weak, fine, subangular blocky structure; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; few fine roots; common very fine and fine tubular pores; few thin clay films on peds and in pores; strongly effervescent to violently effervescent; common, fine, distinct, pink (7.5YR 8/4) filaments of lime, light brown (7.5YR 6/4) when moist; moderately alkaline; clear, wavy boundary.

IIB22tcab—31 to 48 inches, brown (7.5YR 5/4) clay loam, reddish-brown (5YR 4/4) when moist; moderate, medium, subangular blocky structure; hard when dry, friable when moist, slightly sticky and plastic when wet; few fine roots; few very fine tubular pores; common thin clay films on peds and in pores; violently effervescent; common, fine and medium, distinct, pink (7.5YR 8/4) filaments and mottles of lime, pink (7.5YR 7/4) when moist; moderately alkaline; gradual, wavy boundary.

IIB3tcab—48 to 60 inches, light-brown (7.5YR 6/4) sandy clay loam, brown (7.5YR 5/4) when moist; weak, medium, subangular blocky structure; hard when dry, friable when moist, slightly sticky and plastic when wet; common very fine and few fine tubular pores; few thin clay films on peds and in pores; violently effervescent; many, medium, distinct, pinkish-white (7.5YR 8/2) lime mottles, pink (7.5YR 8/4) when moist; moderately alkaline.

Depth to the buried IIB2t horizon is dominantly 20 to 30 inches, but ranges from 20 to 39 inches. The soil ranges from effervescent to violently effervescent and is mildly alkaline to moderately alkaline and in a few places is strongly alkaline to very strongly alkaline.

The A and C horizons have hue of 7.5YR and 10YR, value of 5 or 6 dry and 4 or 5 moist, and chroma of 2 to 4 dry and moist. These horizons commonly are fine sandy loam and sandy loam, but contain strata of finer textured or coarser textured material in places. The B2t horizon has hue of 5YR and 7.5YR, value of 5 or 6 dry and 3 to 5 moist, and chroma of 3 to 6 dry and moist. It is clay loam, sandy clay loam, or heavy loam. It is mainly weak or moderate, fine to medium, subangular blocky. In places it is massive. The buried part of the soil contains few to many, very fine to medium filaments and masses of powdery lime. A IIB1b horizon of gravelly sandy loam, sandy clay loam, or gravelly sandy clay loam occurs in places.

Valencia sandy loam (Va).—This nearly level soil is at the lower ends of alluvial fans and valley plains. It occurs throughout the survey area. Slopes are generally less than 1 percent. Unless cultivated, areas are dissected by shallow stream channels at 200- to 500-foot intervals. Areas are generally about 40 acres in size, but range from 2 to 400 acres.

This soil has the profile described as representative of the series. Included in mapping are a few small areas of Collidge sandy loam, Estrella loam, and Mohall sandy loam. Included soils make up about 15 percent of the mapping unit.

This Valencia soil holds 8 to 10 inches of water available to plants. It is used for cotton, alfalfa, sorghum, small grain, safflower, sugar beets, citrus, and truck crops. Part of the city of Phoenix is on the soil. A few areas are used for range. Capability unit I–2 irrigated, subclass VIIc dryland; Loam Upland range site; horticultural group 1; wildlife habitat group 1 irrigated, 11 dryland.

Valencia sandy loam, saline-alkali (Vb).—This nearly level soil is on alluvial fans and valley plains in the Harquahala Valley and near Wintersburg. Unless cultivated, it is hummocky. Slopes are less than 1 percent. Areas are oval in shape and range from 2 to 50 acres in size.

This soil has a profile similar to the one described as representative of the series, but is strongly saline to very strongly saline and alkaline in the lower part. Included in mapping are small areas of Casa Grande sandy loam; Antho sandy loam, saline-alkali, 0 to 1 percent slopes; Estrella loam, saline-alkali; and Coolidge sandy loam, 0 to 1 percent slopes. Included soils make up about 30 percent of the mapping unit.

Permeability is slow in the lower part of the soil. The available water capacity is 6 to 8 inches.

This Valencia soil is used for cotton, alfalfa, barley, sorghum, sugar beets, and safflower. About half the acreage is used for range and is not cultivated. Capability unit IIs–9 irrigated, subclass VIIs dryland; Saline Upland range site; horticultural group 5; wildlife habitat group 1 irrigated, 11 dryland.

Valencia gravelly sandy loam (Vc).—This nearly level soil is on alluvial fans and valley plains. It occurs throughout the survey area. Slopes are slightly convex and less than 1 percent. Areas are long and narrow and about 10 acres in size.

This soil has a profile similar to the one described as representative of the series, but the upper 10 to 30 inches is 15 to 35 percent gravel and the available water capacity is 7.5 to 8.5 inches. Included in mapping are a few small areas of Antho gravelly sandy loam, 0 to 1 percent slopes; Carrizo gravelly sandy loam; and Estrella loam. Included soils make up about 20 percent of the unit.

This Valencia soil holds 8 to 10 inches of water available to plants. About half the acreage is cultivated. Cotton, alfalfa, barley, safflower, citrus, and grapes are the main crops. A few areas are used for range. Capability unit I–2 irrigated, subclass VIIc dryland; Loam Upland range site; horticultural group 1; wildlife habitat group 1 irrigated, 11 dryland.

Vecont Series

The Vecont series consists of deep, well-drained soils. These soils formed in alluvium that was deposited in slightly concave, depressed areas in old alluvial fans and valley plains. The alluvium was derived from a wide mixture of rock, including granite, andesite, rhyolite, schist, limestone, and basalt. Slopes are generally less than 1 percent. Elevations are 1,000 to 1,400 feet. In areas not cultivated, the vegetation is creosotebush, galleta, annual weeds and grasses, and scattered mesquite and paloverde trees. The precipitation is 6 to 8 inches, the mean annual air temperature is 69° to 74° F, and the frost-free season is 260 to 300 days.

In a representative profile the surface layer is brown clay about 15 inches thick. The subsoil is reddish-brown, brown, and light-brown clay to a depth of 65 inches. The lower part of the subsoil contains segregations of lime and common lime concretions. The soil is slightly effervescent to strongly effervescent and moderately alkaline throughout.

Permeability is slow. Runoff is slow, and the erosion hazard is slight. The available water capacity is 8 to 10 inches. Roots penetrate to a depth of 60 inches or more. These soils commonly crack when dry.

Vecont soils are used for irrigated crops and range. Irrigated crops are cotton, alfalfa, barley, sugar beets, sorghum, grapes, and citrus. A few areas are used as building sites.

Representative profile of Vecont clay, 660 feet west and 50 feet north of the southwest corner of SE¼ of sec. 29, T. 4 N., R. 1 E., in a cultivated field north of Sun City:

Ap—0 to 15 inches, brown (10YR 5/3) light clay, dark brown (10YR 4/3) when moist; massive; hard when dry, firm when moist, sticky and very plastic when wet; slightly effervescent; moderately alkaline; abrupt, smooth boundary.

B21t—15 to 33 inches, reddish-brown (5YR 4/4) clay, dark reddish brown (5YR 3/4) when moist; weak, coarse, prismatic and weak, coarse, subangular blocky structure; very hard when dry, firm when moist, sticky and very plastic when wet; very few, very fine tubular pores; common thin clay films on peds and in pores; compacted at a depth of 15 to 20 inches; noneffervescent and slightly effervescent in root channels; moderately alkaline; abrupt, smooth boundary.

B22tca—33 to 47 inches, brown (7.5YR 5/4) clay, reddish brown (5YR 4/4) when moist; weak, coarse, prismatic structure parting to weak, medium, subangular blocky; very hard when dry, very firm when moist, sticky and very plastic when wet; few fine tubular pores; common thin clay films on peds and in pores; strongly effervescent to violently effervescent; common fine and very fine filaments and irregularly shaped concretions of lime and distinct, pinkish-white (7.5YR 8/2) masses of lime; moderately alkaline; abrupt, smooth boundary.

B23tca—47 to 51 inches, brown (7.5YR 5/4) heavy clay loam or clay, dark brown (7.5YR 4/4) when moist; weak, coarse, prismatic structure parting to weak, medium, subangular blocky; very hard when dry, firm when moist, sticky and plastic when wet; few fine tubular pores; common thin clay films on peds and in pores; few worm casts; strongly effervescent; many, fine and medium, white (7.5YR 8/2) masses and common irregularly shaped concretions and filaments of lime; moderately alkaline; abrupt, smooth boundary.

B24t—51 to 65 inches, light-brown (7.5YR 6/4) clay or clay loam, brown (7.5YR 5/4) when moist; moderate, fine, subangular blocky structure; hard when dry, firm when moist, sticky and very plastic when wet; few fine tubular pores; few thin clay films on peds and in pores; 10 percent gravel; violently effervescent; many prominent, medium, pinkish-white (7.5YR 8/2) masses of lime and few, extremely hard, irregularly shaped lime concretions; moderately alkaline.

The soil is generally slightly effervescent, but in some uncultivated areas it is noneffervescent to a depth of 20 inches or more. Depth to lime accumulation ranges from 30 to 36 inches.

The A horizon has hue of 10YR and 7.5YR, value of 5 or 6 dry and 3 or 4 moist, and chroma of 2 to 4 dry and moist. It is loam, heavy clay loam, heavy silty clay loam, clay, and heavy sandy clay loam. The B2t horizon has hue of 7.5YR and 5YR, value of 4 or 5 dry and 3 to 5 moist, and chroma of 3 or 4 dry and moist. It is heavy clay loam, clay, silty clay, and sandy clay. It is mainly weak prismatic or weak to moderate subangular blocky, but in places is massive. In places, a clay loam Cca horizon is below a depth of 30 inches.

Vecont loam (Ve).—This soil is in slightly concave stream channels and slight depressions on old alluvial fans and valley plains. It is mainly near McMicken Dam. Runoff from the surrounding, gently sloping soils on hills has formed a few shallow gullies. Slopes are less than 1 percent. Areas are long and narrow and range from 30 to 160 acres in size.

This soil has a profile similar to the one described as representative of the series, but the surface layer is loam 5 to 10 inches thick. Included in mapping are small areas of Mohall loam; Gilman loam, 0 to 1 percent slopes; Laveen loam, 0 to 1 percent slopes, and a few areas of soils containing excessive saline or alkali salts, or both. The total extent of all included soils does not exceed 15 percent.

This Vecont soil is used chiefly for range. A few areas are cultivated. Cotton, alfalfa, and small grains are the crops grown. Capability unit IIIs–8 irrigated, subclass VIIs dryland; Clay Bottom range site; horticultural group 3; wildlife habitat group 3 irrigated, 9 dryland.

Vecont clay (Vf).—This nearly level soil is in slightly concave, depressed areas and stream channels in old alluvial fans and valley plains, mainly in the northern part of the Salt River Valley. Areas are long and narrow and about 40 acres in size.

This soil has the profile described as representative of the series. Included in mapping are small areas of Mohall clay loam; Estrella loam; and Laveen loam, 0 to 1 percent slopes. Included soils make up less than 15 percent of the mapping unit.

This Vecont soil is used mainly for cotton, alfalfa, barley, sugar beets, sorghum, grapes, and citrus. A few areas are used for range, and a few areas are used as homesites and industrial sites. Capability unit IIIs–3 irrigated, subclass VIIs dryland; Clay Bottom range site; horticultural group 3; wildlife habitat group 3 irrigated, 9 dryland.

Vint Series

The Vint series consists of deep, well-drained soils on flood plains and low terraces along the major streams of the area. These soils formed in recent alluvium derived from igneous, metamorphic, and sedimentary rocks. Slopes are 0 to 1 percent. Elevations are 750 to 1,300 feet. The native vegetation is creosotebush, tamarix, saltcedar, desertwillow, catclaw, and annual weeds and grasses. The average annual rainfall is 6 to 8 inches, the mean annual air temperature is 69° to 74° F, and the frost-free season is 250 to 290 days.

In a representative profile the soil is pale-brown loamy fine sand to a depth of 60 inches. It is stratified with thin layers of finer textured and coarser textured material. The soil is moderately alkaline and slightly effervescent.

Permeability is moderately rapid. Runoff is very slow or medium, and the erosion hazard is slight. The available water capacity is 5 to 7 inches. Roots penetrate to a depth of 60 inches or more.

Vint soils are used for irrigated crops, range, recreation, and wildlife. Irrigated crops are cotton, alfalfa, small grains, safflower, sugar beets, sorghums, citrus, and vegetables. A few areas are used as homesites.

Representative profile of Vint loamy fine sand, 1,200 feet north and 1,200 feet west of the southeast corner of sec. 26, T. 1 N., R. 2 W. in an uncultivated area:

A1—0 to 2 inches, pale-brown (10YR 6/3) loamy fine sand, dark brown (10YR 4/3) when moist; very weak, coarse, platy structure; soft when dry, very friable when moist, nonsticky and nonplastic when wet; many very fine roots; very slightly effervescent; moderately alkaline; abrupt, smooth boundary.

C1—2 to 27 inches, pale-brown (10YR 6/3) loamy fine sand, dark brown (10YR 4/3) when moist; single grained; soft when dry, very friable when moist, nonsticky and nonplastic when wet; common very fine roots; slightly effervescent; moderately alkaline; abrupt, smooth boundary.

C2—27 to 31 inches, pale-brown (10YR 6/3) stratified very fine sandy loam and loamy fine sand, dark brown (10YR 4/3) when moist; massive; slightly hard and soft when dry, very friable when moist, nonsticky and nonplastic when wet; slightly effervescent; moderately alkaline; abrupt, smooth boundary.

C3—31 to 60 inches, pale-brown (10YR 6/3) loamy fine sand, dark brown (10YR 4/3) when moist; single grained; soft when dry, very friable when moist, nonsticky and nonplastic when wet; slightly effervescent; moderately alkaline; abrupt, smooth boundary.

The soil has hue of 10YR and 7.5YR, value of 5 or 6 dry and 3 to 5 moist, and chroma of 2 to 4 dry and moist. It contains few to many mica flakes and in places filaments or threads of lime.

The A horizon ranges from fine sand to clay loam and is slightly to strongly calcareous. The soil between depths of 10 and 40 inches ranges from loamy sand to loamy fine sand and has common, thin strata of fine sandy loam, sandy loam, very fine sandy loam, and sand. A few to many, fine, water-worn pebbles occur throughout the profile, but never exceed 15 percent of the soil mass.

Vint loamy fine sand (Vg).—This level or nearly level soil is on flood plains and terraces along major streams. It occurs throughout the survey area. Unless cultivated, areas are generally hummocky. Slopes are generally less than 1 percent, but some short side slopes are nearly 2 percent. Areas are generally long and narrow and range from 4 to 250 acres in size.

This soil has the profile described as representative of the series. Included in mapping are a few small areas of Antho sandy loam, 0 to 1 percent slopes; Carrizo gravelly sandy loam; Brios sandy loam; Maripo sandy loam; Gilman fine sandy loam; and a few small areas of soils along the Gila River that contain an excessive amount of soluble salts. Included soils make up about 23 percent of the mapping unit.

This Vint soil is used for cotton, alfalfa, small grain, safflower, citrus, and truck crops. A few areas are used for range. Capability unit IIIs–7 irrigated, subclass VIIs dryland; Sandy Bottom range site; horticultural group 4; wildlife habitat group 4 irrigated, 11 dryland.

Vint fine sandy loam (Vh).—This level to nearly level soil is on flood plains and low terraces along major streams. It occurs throughout the survey area. Unless cultivated, areas are hummocky. Slopes are less than 1 percent. Areas are long and narrow and about 30 acres in size.

This soil has a profile similar to the one described as representative of the series, but the surface layer is fine sandy loam 6 to 14 inches thick. Included in mapping are a few small areas of Antho sandy loam, 0 to 1 percent slopes; Brios sandy loam; Maripo sandy loam; and a few areas of soils near the Gila River that contain excessive amounts of soluble salts. Included soils make up about 20 percent of the mapping unit.

Cotton, barley, alfalfa, safflower, sugar beets, sorghums, citrus, and truck crops are grown. A few areas are used for range. A part of the city of Phoenix is on this soil. Capability unit IIs–7 irrigated, subclass VIIs dryland; Sandy Bottom range site; horticultural group 4; wildlife habitat group 2 irrigated, 11 dryland.

Vint loam (Vk).—This level to nearly level soil is on flood plains and low terraces that parallel major streams. It occurs throughout the survey area. Slopes are generally less than 1 percent. Areas are generally long and narrow. They range from 3 to 70 acres in size, but are commonly about 15 acres.

This soil has a profile similar to the one described as representative of the series, but the surface layer is loam 6 to 14 inches thick. Included in mapping are a few small areas of Antho sandy loam, 0 to 1 percent slopes; Maripo sandy loam; Gilman loam, 0 to 1 percent slopes; and Brios loam, 0 to 1 percent slopes. Included soils make up 20 percent of the mapping unit

Most of the acreage of this Vint soil is cultivated and is used for cotton, alfalfa, sorghums, barley, sugar beets, safflower, citrus, and truck crops. A few areas are used

for range. Capability unit IIs–7 irrigated, subclass VIIs dryland; Sandy Bottom range site; horticultural group 4; wildlife habitat group 2 irrigated, 11 dryland.

Vint clay loam (Vn).—This level to nearly level soil is on flood plains and low terraces along the Gila and Hassayampa Rivers near Palo Verde and Arlington. Slopes are less than 1 percent. Runoff is medium. Permeability is moderately slow. Areas are long and narrow and parallel the stream channel. They range from 5 to 50 acres in size. This soil has a profile similar to the one described as representative of the series, but the surface layer is loam 8 to 14 inches thick.

Included with this soil in mapping are a few small areas of Cashion clay, saline-alkali; Avondale clay loam; Avonda clay loam; and Brios loam. Included soils make up about 20 percent of the mapping unit.

The entire acreage of this Vint soil is cultivated. Cotton, alfalfa, sugar beets, small grain, sorghum, and safflower are the crops grown. Capability unit IIs–7 irrigated, subclass VIIs dryland; Sandy Bottom range site; horticultural group 4; wildlife habitat group 2 irrigated, 11 dryland.

Vint-Carrizo complex (Vr).—This nearly level mapping unit is on alluvial fans dissected by many intermittent stream channels. It is most extensive in the northwestern part of the Salt River Valley near McMicken Dam. Areas are long and narrow and about 40 acres in size.

This mapping unit is about 55 percent Vint fine sandy loam and Vint loamy fine sand and 30 percent Carrizo gravelly sandy loam and a Carrizo gravelly sand. The Vint loamy fine sand soil and the Carrizo gravelly sandy loam have the profiles described as representative of their respective series. Vint fine sandy loam has a profile similar to the one described as representative of the series, but the surface layer is fine sandy loam 6 to 12 inches thick. Carrizo gravelly sand has a profile similar to the one described as representative of the series, but the surface layer is generally sand. Vint soils are along the margin of intermittent stream channels, and Carrizo soils are in or near the stream channels.

Included with this unit in mapping are small areas of Brios loamy sand, Antho sandy loam, and Torripsamments and Torrifluvents, frequently flooded. The total extent of these included soils is about 15 percent.

This mapping unit is used for range. It is not cultivated. Capability subclass VIIs dryland; Vint soil in Sandy Bottom range site; horticultural group 4; wildlife habitat group 11 dryland. Carrizo soil in Sandy Bottom range site; horticultural group 4; wildlife habitat group 12 dryland.

Wintersburg Series

The Wintersburg series consists of deep, well-drained soils that have visible accumulations of lime at a moderate depth. These soils are at the ends of alluvial fans and valley plains near Buckeye. They formed in old alluvium that was derived from granite, gneiss, andesite, tuff, basalt, and limestone. Slopes are less than 1 percent. Elevations are 750 to 900 feet. The average annual rainfall is 6 to 8 inches, the mean annual air temperature is 69 to 74° F, and the frost-free season is 250 to 290 days.

In a representative profile the surface layer is brown clay loam about 12 inches thick. The underlying material is light yellowish-brown sandy loam to a depth of 18 inches and very pale brown loam to a depth of 60 inches. The lower part of the underlying material contains large amounts of lime. The soil is moderately alkaline throughout.

Permeability is modertely slow. Runoff is medium, and the erosion hazard is slight. The available water capacity is 10 to 12 inches. Roots penetrate to a depth of 60 inches or more.

Wintersburg soils are used for cotton, alfalfa, barley, sugar beets, sorghum, safflower, and lettuce. Nearly all the acreage is cultivated. Part of the city of Buckeye is on these soils.

Representative profile of Wintersburg clay loam in an area of Wintersburg complex, 948 feet north and 69 feet west of the southeast corner of sec. 3, T. 1 S., R. 4 W. in a cultivated field near Palo Verde:

Ap—0 to 12 inches, brown (10YR 5/3) clay loam, dark brown (7.5YR 3/2) when moist; weak, fine, subangular blocky structure; hard when dry, friable when moist, sticky and plastic when wet; common fine roots; few fine tubular and interstitial pores; strongly effervescent; moderately alkaline; abrupt, smooth boundary.

IIC1—12 to 18 inches, light yellowish-brown (10YR 6/4) heavy sandy loam, brown (7.5YR 5/4) when moist; massive; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; common fine roots; common fine tubular pores; 2 percent fine gravel; violently effervescent; moderately alkaline; abrupt, smooth boundary.

IIC2ca—18 to 60 inches, very pale brown (10YR 7/4) heavy loam, brown (7.5YR 5/4) when moist; massive; hard when dry, friable when moist, slightly sticky and plastic when wet; few fine roots; many fine tubular pores; violently effervescent; many, fine and medium, distinct, white (10YR 8/2), soft lime masses, pink (7.5YR 8/4) when moist; moderately alkaline.

Depth to the Cca horizon ranges from 12 to 31 inches. The Ap horizon has hue of 7.5YR and 10YR, value of 4 to 5 dry and 3 moist, and chroma of 2 or 3 dry and moist. It is clay loam, silty clay, and clay. The C horizon has hue of 7.5YR and 10YR, value of 5 to 8 dry and 4 to 7 moist, and chroma of 3 or 4 dry and moist. The IIC2ca horizon is loam, heavy sandy loam, light clay loam, or very fine sandy loam. It ranges from 15 to 40 percent calcium carbonate and is less than 10 percent semirounded lime concretions. This horizon is weakly cemented in places.

Wintersburg complex (Wg).—This mapping unit is at the lower ends of old valley plains west of Buckeye. The surface is smooth. Slopes are less than 1 percent. In cultivated areas, fine sediment carried in the muddy irrigation water from the Buckeye Irrigation District canal accumulates on the surface. Areas are oval in shape and about 10 acres in size.

This mapping unit is about 50 percent Wintersburg clay loam and 35 percent Wintersburg clay. Wintersburg clay loam has the profile described as representative of the series. It is at the upper ends of fields. Wintersburg clay has a profile similar to the one described as representative of the series, but the surface layer is clay or silty clay about 10 to 18 inches thick. This soil is at the lower ends of fields.

Included with this unit in mapping are a few small areas of Cashion clay, saline-alkali; Avondale clay loam; Laveen loam, 0 to 1 percent slopes; and other soils similar to Wintersburg soils but slightly saline to moderately saline. Included soils make up about 15 percent of the mapping unit.

All the acreage of this mapping unit except that in the town of Buckeye is irrigated. Crops are cotton, alfalfa, barley, sugar beets, sorghum, safflower, and lettuce. Capability unit IIIs–3 irrigated, subclass VIIs dryland; horticultural group 2; wildlife habitat group 3 irrigated, 11 dryland.

Use and Management of the Soils

General practices of good management for all soils of Maricopa County, Central Part, are suggested on the pages that follow. The capability grouping used by the Soil Conservation Service, in which the soils are grouped according to their suitability for crops, and the system adopted locally by the State of Arizona are explained. Management is suggested, by capability unit, for irrigated crops and range. Estimated yields of the principal crops are listed in table 2.

This part of the survey also contains information on range management and general suggestions for improvement of wildlife habitat. It reports data from engineering tests and interpretations of soil properties that affect highway construction and other engineering structures. It also contains information on developing recreational facilities and establishing plantings of specified trees and shrubs.

General Management

Management and hazards common to all soils of the area are defined in the paragraphs that follow.

Organic matter and crop residue.—All soils in the survey area are low in content of organic matter. Disking or plowing under barley and sorghum stubble, sugar beet tops, and other crop residue are important sources of organic matter. The addition of organic matter to the soil increases fertility, aeration, and moisture penetration and also maintains or improves tilth. Organic matter can also be improved by adding gin trash or manure, but using large amounts of manure can build up salt content. Additional amounts of nitrogen should be incorporated into the soil to aid in the breakdown of crop residue high in cellulose. Leaving the soil fallow for any length of time adversely affects the content of organic matter.

Irrigation.—Irrigation water management is controlling or regulating the application of irrigation water in such a way that high crop yields are obtained without wasting water or losing soil. Water is the most precious resource in Maricopa County, Central Part, and careful water management is needed on all soils.

To irrigate properly, the farmer must know the amount of water the soil will hold, the depth to which plant roots penetrate, and the water requirement of crops. Most crops should be irrigated when 40 to 50 percent of the available soil moisture is depleted. Checking with a soil probe or auger can determine the moisture content of the root zone. Visible plant symptoms of moisture stress are wilting leaves, bluish-green leaves, warm leaves, or slow growth rates. The soil should be checked 48 hours after irrigation to determine if water was added uniformly to the desired depth.

The furrow and border methods of irrigation are most widely used in the survey area. Borders are used for alfalfa, pasture grasses, and small grain, and furrows for most row crops and some small grain. Citrus and other trees require a modification of the furrow system. Small basins around each tree are connected with furrows. Sprinklers are sometimes used for shallow-rooted crops, such as vegetables, for germination of seeds. They are also used on very sandy soils.

If water is applied too rapidly to fine-textured soils, such as Gadsden and Cashion soils, it runs off. If water is applied too rapidly on coarse-textured soils, such as Brios and Carrizo soils, it penetrates below the root zone and is lost. A properly designed irrigation system matches the soil characteristics with the right grade and length of run. Water can be conserved by using pipelines and cement-lined ditches and reusing irrigation tail water. General suggestions are given in the description of each capability unit. More specific suggestions are available in the local Soil Conservation Service field office.

Fertilization.—Fertilizer is generally required to obtain profitable yields in the survey area. The amount and kind needed vary according to the crop and kind of soil. Few general suggestions can be made. All crops respond to nitrogen. Alfalfa needs only small amounts and then only during the first year. Many crops, especially alfalfa, respond to applications of phosphorus. Soils that contain a large quantity of lime at or near the surface should receive split applications of phosphorus because it is readily tied up in the soil. Lime-induced chlorosis is a serious concern for such crops as citrus and sorghum. All soils, but especially those high in content of lime, benefit from manure. Some soils, especially those high in content of lime, are deficient in micronutrients, such as iron.

Tillage.—The soils in this survey area generally have poor tilth. Excessive tillage breaks down tilth, compacts the soil, and restricts the movement of air and water. The soil should not be tilled when wet because a plowpan easily forms, tilth is destroyed, and clods form. A tillage pan, or plowpan, is a compacted layer formed by the weight of tillage equipment as it passes through the soil. Such pans can be prevented by varying the depth of plowing. If a pan has formed already, it can be broken by chiseling or subsoiling. Growing deep-rooted crops, such as alfalfa, is beneficial. Well-drained access roads reduce travel in the fields and reduce compaction. Controlling weeds by chemicals is one way of reducing tillage. Cotton should not be grown on any one acreage year after year. A crop rotation of 1 to 2 years cotton followed by barley, safflower, or alfalfa is satisfactory.

Saline and alkali soils.—Most soils in arid regions contain soluble salts and in places these salts are concentrated. The source of salts is the primary minerals found in rock formations. Salts set free by weathering tend to remain in soils of arid regions because the combination of low rainfall and high evaporation prevents the leaching of salts. Some saline-alkali soils occur in areas receiving salts from other places. In such areas water is the primary carrier. Four main classes of salinity and alkalinity have been mapped in Maricopa County, Central Part.

Nonsaline, nonalkaline soils have a conductivity of the saturation extract of less than 4 millimhos per centimeter at 25° C. The exchangeable sodium percentage is less than 15, and the pH value is less than 8.5. Most soils in the survey area are nonsaline and nonalkaline.

Saline soils have a conductivity of the saturation extract of greater than 4 millimhos per centimeter at

25° C. The exchangeable sodium percentage is less than 15, and the pH value is below 8.5. The Gilman loam, clayey subsoil variant, moderately saline, is the only soil in this class.

Saline-alkaline soils have a conductivity of the saturation extract of greater than 4 millimhos per centimeter at 25° C and an exchangeable sodium percentage greater than 15. The pH value ranges from 7.9 to 10. Most soils that are too saline or too alkaline are in this class. Gilman loam, saline-alkali, and Antho sandy loam, saline-alkali, are examples.

Alkaline soils have an exchangeable sodium percentage of more than 15 and a conductivity of the saturation extract of less than 4 millimhos per centimeter at 25° C. The pH value ranges from 8.5 to 10. The Casa Grande and La Palma soils are examples.

Removal of salts and alkali requires special treatment on an individual field basis. Saline soils can generally be improved by deep leaching with good quality irrigation water. Saline-alkali and alkali soils under certain conditions require soil amendments to aid in their reclamation and removal of alkali salts. The quality of irrigation water used for reclamation also must be evaluated. Adequate drainage is necessary in all areas. The soil amendments generally used are gypsum, calcium polysulfide, or sulfuric acid. The soil amendment selected depends upon the cost, the needs of the individual soils, the availability, and the facilities available for application. Generally the first crop planted on a soil that is being reclaimed is bermudagrass. It is followed by barley and then alfalfa as the field improves.

The salts content of the irrigation water used in this survey area ranges from about 700 to more than 4,000 parts per million. Long, continued irrigation ultimately produces a saline or saline-alkali soil unless the soil is deeply leached occasionally. The suggested number of leachings varies with the soil and the type and quantity of salts in the irrigation water. A properly leveled field can be leached readily and can prevent the accumulation of salts within the root zone.

Capability Grouping

Capability groupings shows, in a general way, the suitability of soils for most kinds of crops. The groups are made according to the limitations of the soils when used for field crops, the risk of damage when they are so used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to horticultural crops, or other crops requiring special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range, for forest trees, or for engineering.

In the capability system, all kinds of soil are grouped at three levels, the capability class, the subclass, and the unit. These levels are described in the following paragraphs.

Capability Classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use, defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use largely to pasture or range, woodland, or wildlife.

Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife.

Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture or range, woodland, or wildlife.

Class VIII soils and landforms have limitations that preclude their use for commercial crops and restrict their use to recreation, wildlife, or water supply, or to esthetic purposes.

Capability Subclasses are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example IIe. The letter *e* shows that the main limitation is risk of erosion; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture, range, woodland, wildlife, or recreation.

Capability Units are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe–4 or IIIs–7. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass.

Managing irrigated soils, by capability units[3]

On the pages that follow, each capability unit in the survey area is described and the use and management are briefly discussed. The names of the soil series represented are mentioned, but this does not mean that all of the soils in a given series are in that unit. To find the capability unit for a specific soil, refer to the Guide to Mapping Units at the back of the survey.

Irrigation is needed to grow crops in this area, and about 30 percent of the acreage is irrigated. The water is supplied from several sources and varies considerably in quality and quantity. Surface water comes from several reservoirs on the Agua Fria, Salt, and Verde Rivers. Underground water supplements surface water in some areas but in others is the sole source of supply.

Most crops commonly grown in the area are listed in table 2. In addition to the crops listed, the soils of this area are used for wheat, grapes, lettuce, cabbage, broccoli, carrots, radishes, onions, potatoes, tomatoes, cantaloupe, watermelon, strawberries, roses, pecans, plums, apricots, and dates. Also, some areas are used as pasture.

CAPABILITY UNIT I-1 IRRIGATED

Soils of the Avondale, Estrella, Gilman, Glenbar, Laveen, Mohall, and Tucson series are in this unit. They are loams or clay loams that are relatively free of salts and alkali. Laveen, Mohall, and Tucson soils have concentrations of lime at a depth of 14 to 26 inches. Slopes are 0 to 1 percent.

Permeability is moderate to moderately slow. Runoff is medium to very slow, and the erosion hazard is slight. The available water capacity is 6 to 13.5 inches. Roots can penetrate to a depth of 60 inches or more.

These soils are used for cotton, alfalfa, small grain, sugar beets, safflower, citrus, grapes, and truck crops. Extensive areas are home and industrial sites. Lime-induced chlorosis is sometimes evident in citrus grown on these soils.

No specific limitations are inherent to soils of this unit. The clay loam in the surface layer is more susceptible than other material to the formation of a tillage pan. Land leveling or shaping does not expose unfavorable subsoil material, but cuts of 1 foot to 2 feet expose concentrations of lime in Laveen, Mohall, and Tucson soils. Generally irrigation runs should be no longer than 1,320 feet.

CAPABILITY UNIT I-2 IRRIGATED

Soils of the Gilman, Laveen, Mohall, and Valencia series are in this unit. They have a surface layer of sandy loam and underlying material of loam or clay loam. All are relatively free of toxic concentration of salts and alkali. Laveen and Mohall soils have accumulations of lime within 24 inches of the surface.

Permeability is moderate to moderately slow. Runoff is slow to medium, and the erosion hazard is slight. The available water capacity is 8 to 12 inches.

These soils are suited to all the climatically adapted crops of the area. Lime-induced chlorosis affects citrus trees in some areas of Laveen and Mohall soils.

No specific limitations are inherent to soils of this unit, but the moisture needs in the first foot of root zone are important. Light, frequent applications of water are needed when plants are young. Cuts made in land leveling or shaping that are deeper than 1½ feet can expose the underlying concentrations of lime in Mohall and Laveen soils. Irrigation runs should be no longer than 1,320 feet. Sprinklers can be used for shallow-rooted crops, such as vegetables.

CAPABILITY UNIT IIe-1 IRRIGATED

Soils of the Gilman and Laveen series are in this unit. They are loams that are relatively free of toxic concentration of salts or alkali. Laveen soils have concentrations of lime within 24 inches of the surface. Slopes are 1 to 3 percent.

Permeability is moderate. Runoff is slow to medium, and the erosion hazard is moderate. The available water capacity is 8 to 11 inches. Roots can penetrate to a depth of 60 inches or more.

These soils are suited to all climatically adapted crops of the area. Lime-induced chlorosis can affect citrus trees in some areas of Laveen soils.

The major limitations are the slope and the erosion hazard. The erosion hazard can be reduced by irrigating on the contour or across the slope. Deep cuts in land leveling expose the underlying concentration of lime in the Laveen soils. Generally irrigation runs should be no longer than 880 feet.

CAPABILITY UNIT IIe-4 IRRIGATED

Two soils of the Antho series are in this unit. These soils are relatively free of toxic concentration of salts and alkali.

Permeability is moderately rapid. Runoff is medium, and the erosion hazard is moderate. The available water capacity is 5 to 6 inches. Roots penetrate to a depth of 60 inches or more.

These soils are used for cotton, alfalfa, safflower, small grain, and citrus.

The major limitation is the slope, the accompanying moderate erosion hazard, and a slightly reduced water capacity. The erosion hazard can be reduced by irrigating on the contour or across the slope. The soils generally appear droughty if they occur in a field with soils that hold more available water. If feasible, the irrigation system should be designed so that they can be irrigated separately and more frequently. Generally irrigation runs should be no longer than 1,320 feet. Sprinklers can be used for shallow-rooted crops. Leveling is suggested. Ordinarily no unfavorable material is exposed in cuts within a depth of 40 inches.

CAPABILITY UNIT IIe-6 IRRIGATED

Soils of the Rillito and Tremant series are in this unit. They have a surface layer of sandy loam, loam, or gravelly loam and underlying layers of gravelly loam, gravelly sandy loam, or gravelly clay loam. All are relatively free of toxic concentrations of salts and alkali. Concentrations of lime are at a depth of less than 20 inches.

Permeability is moderately rapid to moderately slow. Runoff is slow to medium, and the erosion hazard is slight to moderate. The available water capacity is 5 to 8 inches. Roots penetrate to a depth of 60 inches or more.

These soils are suited to most of the climatically adapted crops of the area. Citrus trees and sorghum become chlorotic in some areas of these soils.

[3] ARNOLD NOWOTNY, conservation agronomist, Soil Conservation Service, Phoenix, Arizona, helped prepare this section.

The main limitations are the slope, the erosion hazard, and a slightly reduced water capacity. The erosion hazard can be reduced by irrigating on the contour or across the slope. Special attention must be given to the frequency of irrigation because the soils appear droughty if they are adjacent to soils that hold more available water. Cuts made in land leveling or shaping that are deeper than 1 foot can expose the underlying concentrations of lime. Applications of manure are beneficial in leveled areas where cuts have exposed lime concentrations. Phosphorus should be applied in split applications during the growing season in such areas because it is readily tied up in the soil. Generally irrigation runs should be no more than 1,320 feet long.

CAPABILITY UNIT IIc-7 IRRIGATED

Soils of the Coolidge and Perryville series are in this unit. They have a surface layer of gravelly sandy loam or gravelly loam and a subsoil of sandy loam or gravelly loam. All are relatively free of toxic concentrations of salts and alkali, but have concentrations of lime at or near the surface. Slopes are 1 to 3 percent.

Permeability is moderate to moderately rapid. Runoff is slow to medium, and the erosion hazard is slight to moderate. The available water capacity is 6 to 7 inches. Roots penetrate to a depth of 60 inches or more.

These soils are used for cotton, alfalfa, barley, safflower, and citrus. Lime-induced chlorosis is sometimes evident in citrus grown on these soils. The soils are not suited to sorghum and related crops.

The main limitations are the slope, the erosion hazard, the limited water capacity, and the concentrations of lime at or near the surface. The hazard of erosion can be reduced by irrigating on the contour or across the slope. Special attention must be given to the frequency of irrigation. These soils appear droughty if they are adjacent to soils that hold more available water. If feasible, the irrigation system should be designed so that they can be irrigated more frequently than those soils. Also they should be leveled to properly utilize the irrigation water. Lime is at or near the surface in the Perryville soils, and productivity is not reduced by deep cuts. Land smoothing or leveling cuts of more than 8 to 16 inches expose the concentrations of lime in the Coolidge soils. Adding manure or gin trash or plowing under green-manure crops is beneficial in cut areas. Phosphorus should be applied in several applications during the growing season in such areas because it is readily tied up in the soil. Specialty crops, such as roses or citrus, benefit from applications of iron. Generally, irrigation runs should be no longer than 1,320 feet.

CAPABILITY UNIT IIs-4 IRRIGATED

Soils of the Antho series are in this unit. They are sandy loams or gravelly sandy loams that are relatively free of toxic concentrations of salts and alkali. Slopes are less than 1 percent.

Permeability is moderately rapid. Runoff is slow, and the erosion hazard is slight. The available water capacity is 5 to 7 inches. Roots penetrate to a depth of 60 inches or more.

These soils are used for most of the locally grown crops.

The major limitation is a slightly limited available water capacity. Special attention should be given to the frequency of irrigation. These soils appear droughty in fields with soils that hold more available water. If feasible, the irrigation system should be designed so that they can be irrigated separately and more frequently. Deep cuts in land leveling do not expose unfavorable material. Irrigation runs should be no longer than 880 feet. Sprinklers can be used in some areas for shallow-rooted crops.

CAPABILITY UNIT IIs-6 IRRIGATED

Soils of the Rillito and Tremant series are in this unit. They have a surface layer of sandy loam, loam, gravelly loam, or gravelly clay loam. The subsoil is gravelly loam, gravelly clay loam, or clay loam, and the underlying material is gravelly loam. The soils are relatively free of toxic concentrations of salts and alkali. They have concentrations of lime at a depth of 10 to 14 inches. Slopes are 0 to 1 percent.

Permeability is moderate to slow. Runoff is slow to medium, and the erosion hazard is slight. The available water capacity is 5 to 8 inches. Roots penetrate to a depth of 60 inches or more.

These soils are used for cotton, alfalfa, barley, safflower, citrus, and sorghums. Lime-induced chlorosis is sometimes evident in citrus grown on these soils. Sorghum becomes chlorotic if grown in areas of Rillito soils.

The main limitation is the content of coarse fragments and the reduced water capacity. Special attention must be given to the frequency of irrigation. These soils appear droughty in fields with soils that hold more available water. If feasible, the irrigation system should be designed so that they can be irrigated separately and more frequently. Generally irrigation runs should be no longer than 880 feet. Deep cuts in land leveling generally expose concentrations of lime and more gravelly material.

CAPABILITY UNIT IIs-7 IRRIGATED

Soils of the Agualt, Avonda, Coolidge, Perryville, Toltec, Tremant, and Vint series are in this unit. The surface layer of these soils ranges from sandy loam to clay loam. Perryville soils have a surface layer of gravelly loam. Agualt, Avonda, and Vint soils are underlain by sand or loamy sands at a depth of 6 to 39 inches. Tremant and Perryville soils have a gravelly loam or gravelly clay loam subsoil. Toltec soils have a weakly cemented pan at a depth of about 28 inches. Coolidge soils have a sandy loam subsoil. All are relatively free of toxic concentrations of salts and alkali. Coolidge, Perryville, Toltec, and Tremant soils have concentrations of lime at or near the surface. Slopes are less than 1 percent.

Permeability is moderately rapid to slow. Runoff is very slow to medium, and the erosion hazard is slight. The available water capacity is 5 to 8 inches. Roots penetrate to a depth of more than 60 inches in all but the Toltec soil, which is only 20 to 40 inches deep over a hardpan.

These soils are used for most crops grown in the area. Perryville soils are not suited to citrus and sorghum. Lime-induced chlorosis is sometimes evident in citrus grown on Tremant and Coolidge soils. Alfalfa does not grow well on the Toltec soil.

The main limitation is the limited water capacity. The limited root zone is an additional limitation on the Toltec soil. Careful attention must be given to the frequency of irrigation if the soils in this unit are in fields with soils that hold more available water. If feasible, the irrigation system should be designed so that they can be irrigated separately and more frequently. Irrigation runs should be

no longer than 880 feet. Deep cuts in land leveling expose the underlying concentration of lime.

CAPABILITY UNIT IIs-9 IRRIGATED

This unit consists of saline-alkali soils of the Antho, Avondale, Estralla, Gilman, Glenbar, Laveen, and Valencia series. The texture ranges from sandy loam to clay loam. Laveen soils have concentrations of lime at a depth of less than 30 inches. Slopes are 0 to 1 percent.

Permeability is moderately rapid to slow. Runoff is slow to medium, and the erosion hazard is slight. The available water capacity is 5 to 12 inches. Roots penetrate to a depth of 60 inches or more.

These soils are used for cotton, alfalfa, barley, safflower, sugar beets, and sorghum.

The main limitation is the toxic concentration of salts and alkali, which reduces the amount of water available to plants. Careful attention must be paid to the frequency of irrigation. Several leaching irrigations are needed each year. Generally deep cuts do not expose unfavorable material. Concentrations of lime, however, are within 30 inches of the surface in Laveen soils. Irrigation runs should be no longer than 1,320 feet.

CAPABILITY UNIT IIIs-3 IRRIGATED

Soils of the Gadsden, Glenbar, Mohall, Vecont, and Wintersburg series are in this unit. They have a surface layer of clay, and the underlying material ranges from loam to clay. All are relatively free of toxic concentrations of salts and alkali. Mohall soils have concentrations of lime at a depth of less than 30 inches. Slopes are less than 1 percent.

Permeability is moderately slow or slow. Runoff is slow to medium, and the erosion hazard is slight. The available water capacity is 8 to 13 inches. Roots penetrate to a depth of 60 inches or more.

These soils are used for most locally grown crops. Citrus trees readily become chlorotic if the soils are waterlogged.

The main limitation is the clay surface layer and the resulting slow intake rate. Care must be taken to ensure adequate penetration of water. These soils are easily compacted if tilled when wet. Plowpans are prevalent. Crop residue should be returned to the soil. Also, applications of manure or gin trash or plowing under green-manure crops improves tilth and increases the water intake rate. In order to avoid scalding the plants in hot weather, irrigation sets for alfalfa should not exceed 24 hours. The surface should not become too dry during the growing season because deep cracks form. Several deep leachings each year are needed to remove salts and alkali from the soil. Flat leveling aids in the leaching and removal of salts. Irrigation runs should be no longer than 1,320 feet. Deep cuts do not expose unfavorable material in most of these soils, but cuts of more than 2 feet expose concentrations of lime in the Mohall soils.

CAPABILITY UNIT IIIs-7 IRRIGATED

Soils of the Antho, Brios, Maripo, and Vint series are in this unit. They have a surface layer ranging from loamy sand to loam and underlying material of sand, loamy fine sand, or gravelly loamy sand. They are relatively free of toxic concentrations of salts and alkali. Slopes are less than 1 percent.

Permeability is rapid to moderately rapid. Runoff is very slow to medium. The erosion hazard is slight, but young plants are subject to some wind damage from sand blasting. The available water capacity is 4 to 7 inches. Roots penetrate to a depth of 60 inches or more.

These soils are used for most crops climatically suited to the area.

The main limitation is the limited available water capacity. Special attention must be given to the frequency of irrigation. Many of these soils appear droughty if they are adjacent to soils that hold more available water. If feasible, the irrigation systems should be designed so that they can be irrigated separately and more frequently. Fertilizer containing nitrogen should be applied in two applications, and in small amounts because the nitrogen readily leaches out of the root zone. Manure, gin trash, or green-manure crops improve tilth and increase the available water capacity. Overuse of irrigation water and excessive leaching of fertilizer can occur if the soils are leveled. Irrigation runs should be no longer than 660 feet. Cuts in land leveling should be no deeper than 6 to 12 inches in Maripo and Brios soils. Deep cuts are not damaging in Vint soils.

CAPABILITY UNIT IIIs-8 IRRIGATED

Soils of the Gadsden and Vecont series are in this unit. They have a surface layer of clay loam or loam and the underlying material is clay. They are relatively free of salts and alkali. Slopes are less than 1 percent.

Permeability is slow. Runoff is slow, and the erosion hazard is slight. The available water capacity is 8 to 10 inches. Roots penetrate to a depth of 60 inches or more.

These soils are used for cotton, alfalfa, barley, sugar beets, and sorghum.

The main limitation is slow permeability. Care must be taken to ensure adequate penetration of water. If these soils are in the same field as coarser textured soils, they appear droughty. If feasible, the irrigation system should be designed so that they are irrigated separately and with a smaller head of water. Care must be taken to ensure that these soils are not tilled when wet. They are easily compacted, and a plowpan forms readily. Growing alfalfa and plowing under crop residue increase permeability. In order to avoid scalding the plants in hot weather, irrigation sets for alfalfa should not exceed 24 hours. The soils should be deep leached at least twice a year to prevent the accumulation of salts. Flat leveling helps to deep leach the salts. Irrigation runs should be no longer than 1,320 feet. Sprinklers are not satisfactory because the intake rate is low. No unfavorable material is exposed in land leveling or shaping.

CAPABILITY UNIT IIIs-9 IRRIGATED

Soils of the Casa Grande, La Palma, and Perryville series and the Gilman variant are in this unit. They have a surface layer ranging from sandy loam to loam and underlying material of clay or clay loam. All are severely affected by saline and alkali salts or both. Casa Grande, La Palma, and Perryville soils have concentrations of lime at or near the surface. La Palma soils have an indurated hardpan at a depth of less than 40 inches. Slopes are less than 1 percent.

Permeability is slow to moderate. Runoff is very slow to medium, and the erosion hazard is slight. The available water capacity is 3 to 10 inches. Roots can penetrate to a

depth of 60 inches or more in all but the La Palma soil, which is only 20 to 40 inches deep over a hardpan.

These soils are used for cotton, alfalfa, barley, safflower, sugar beets, and sorghum. The La Palma soil is not suited to citrus or alfalfa unless the indurated hardpan is removed.

The main limitation is the moderate to high toxic concentration of saline or alkali salts or both. Salts is a continuous limitation. Careful attention must be given to the frequency of irrigation because the water available to plants is somewhat restricted by the content of salts. Care must be taken to ensure adequate penetration of irrigation water. Flat leveling and deep leaching are beneficial in reclaiming these soils. Soil amendments improve the infiltration rate of leaching water in some areas. Runs should be no longer than 1,320 feet. Crop residue should be returned to the soil. Adding manure or gin trash or plowing under green-manure crops improves tilth and increases the infiltration of water. Sprinklers are not adequate because the intake rate is slow.

CAPABILITY UNIT IVs-5 IRRIGATED

The one soil in this unit, Pinal loam, 0 to 1 percent slopes, is relatively free of salts and alkali. It is loam or cobbly loam that is 4 to 20 inches over an indurated hardpan.

Permeability is moderate in the upper part of the soil, but the pan is impermeable. Runoff is medium, and the erosion hazard is slight. The available water capacity is 1 to 2 inches. Roots penetrate to a depth of less than 20 inches because of the indurated hardpan.

This soil is used for cotton, barley, wheat, and safflower. It is not suited to deep-rooted plants. It is better suited to pasture than to field crops.

The main limitation is the limited effective depth for water storage and root development. Very careful attention must be given to the frequency of irrigation. The soil appears droughty if it is adjacent to soils that hold more water. If feasible, the irrigation system should be designed so that this soil is irrigated separately and more frequently. The soil is too shallow over a hardpan for land leveling. If feasible, the hardpan can be ripped with heavy equipment and the pan fragments removed from the field. Irrigation runs should be no longer than 440 feet.

CAPABILITY UNIT IVs-7 IRRIGATED

Soils of the Antho, Brios, and Carrizo series are in this unit. These soils are relatively free of toxic concentrations of salts and alkali. They have a surface layer of loamy sand or gravelly sandy loam and underlying material that ranges from very gravelly sand to sand. Slopes are less than 1 percent.

These soils are well drained to excessively well drained. Permeability is rapid. Runoff is slow, and the erosion hazard is slight. The available water capacity is 2 to 5 inches. Roots penetrate to a depth of 60 inches or more.

These soils are used for cotton, alfalfa, barley, and citrus. They are best suited to pasture.

The main limitation is the limited water capacity Special attention must be given to the frequency of irrigation. The soils appear droughty if they are in the same field with soils that hold more water. If feasible, the irrigation system should be designed so that these soils are irrigated separately and more frequently. Irrigation runs should be no longer than 440 feet. Plowing under green-manure crops, crop residue, gin trash, or manure increases the water capacity and improves tilth. Fertilizer should be applied in small amounts and in two applications or it will be leached rapidly from the root zone by irrigation water. Sprinklers are suitable on these soils.

CAPABILITY UNIT IVs-9 IRRIGATED

The two soils in this unit, Cashion clay, saline-alkali, and Gadsden clay, saline-alkali, have toxic concentrations of saline and alkali salts. The Gadsden soil is clay throughout, and the Cashion soil is underlain by silt loam at a depth of about 27 inches. Slopes are less than 1 percent.

Permeability is slow. Runoff is slow, and the erosion hazard is slight. The available water capacity is 9 to 10 inches. Roots penetrate to a depth of 60 inches or more.

These soils are used for cotton, alfalfa, barley, safflower, sugar beets, and sorghum. Sorghum shows the effect of salts in some areas.

The main limitations are the toxic content of saline and alkali salts and the slow rates of infiltration and permeability. Applications of soil amendments are needed on some fields to improve infiltration and to help leach saline and alkali salts. Special attention must be given to the frequency of irrigation. These soils are easily waterlogged. If they are not watered enough, however, they appear droughty. They are easily compacted by tillage equipment, especially if cultivated when wet. All crop residue should be returned to the soil. Green-manure crops, gin trash, and manure improve tilth and the infiltration rate. Fields should be leveled flat to ensure adequate penetration of irrigation water. Irrigation runs should be no longer than 1,320 feet.

Managing dryland soils, by capability subclass

Rainfall in Maricopa County, Central Part, is not sufficient for cultivated crops. All soils in areas where no irrigation water is available are assigned to capability class VII or VIII and are used as range. The vegetation on these soils provides food and shelter for many kinds of wildlife. If irrigation water should become available, many of the soils could be managed according to the management suggested for soils in capability classes I through IV.

CAPABILITY SUBCLASS VIIe DRYLAND

The soils in this subclass are highly variable, but all have slopes of more than 1 percent and a moderate to severe erosion hazard. Some are gravelly, and some are shallow.

Permeability is moderately rapid to slow. Runoff is slow to medium, and the erosion hazard is moderate to severe. The available water capacity is 1 to 6 inches. Roots can penetrate to a depth of 60 inches in most of the soils, but are restricted to 20 inches or less in the more shallow soils.

These soils are used as range and wildlife habitat. For additional information, see the sections on range and wildlife.

The main limitation is the erosion hazard. Rainfall is inadequate for dryland farming, and no irrigation water is available.

CAPABILITY SUBCLASS VIIs DRYLAND

The soils in this subclass are highly variable. They range from sand to clay. Some have toxic quantities of salt, and others have a hardpan at a depth of 10 to 40

inches. Some are gravelly or very gravelly. Others have concentrations of lime. Slopes are less than 1 percent.

Permeability is rapid to slow. Runoff is slow to medium, and the erosion hazard is slight. The available water capacity ranges from 1 to 12 inches. Roots penetrate to a depth of 60 inches or more in most of the soils, but are restricted to 40 inches or less in the soils that have a hardpan.

These soils are used as range and wildlife habitat. For additional information, see the sections on range and wildlife.

The main limitation is limited water capacity, high content of saline or alkali salts or both, slow water infiltration rate, slow permeability, restricted root zone, or a high content of gravel or cobbles.

CAPABILITY SUBCLASS VIIc DRYLAND

Soils in this subclass have a surface layer ranging from sandy loam to clay loam and underlying material of loam or clay loam. All are relatively free of toxic concentrations of saline or alkali salts or both. Some have concentrations of lime. Slopes are less than 1 percent.

Permeability is moderately rapid to moderately slow. Runoff is slow to medium, and the erosion hazard is none to slight. The available water capacity is 8 to 13 inches. Roots penetrate to a depth of 60 inches or more.

These soils are used as range and wildlife habitat. For additional information, see the sections on range and wildlife.

The main limitation is the arid climate.

CAPABILITY SUBCLASS VIII DRYLAND

The soils and land types in this subclass are on low hills and mountains and in stream channels. The low hill and mountain areas are mainly Rock outcrop. The areas in stream channels are subject to frequent flooding. As a result, recreation, wildlife habitat, water supply, and esthetic purposes are the main uses.

Estimated Yields

Table 2 shows estimated average acre yields of the principal crops grown on arable soils under a high level of management. The estimates are based on observations of members of the Soil Conservation Service and the University of Arizona Agricultural Extension Service and on comparison with similar soils in other areas. Averages are those that can be expected over a period of years. In any given year, yields can be considerably higher or considerably lower than those listed in the table.

To achieve the yields shown, it is assumed that a good quality of irrigation water is available, that an adequate amount of fertilizer is applied, and that a soil-conserving cropping system is used. It is further assumed that cotton is a short staple, solid-planted crop that follows a small grain crop, and that all residue is returned to the soil. Alfalfa, grown only for hay, is planted in fall and is not allowed to lie dormant in summer. It has a normal growing season of 3 years. Barley is planted between the middle of November and December. Safflower is planted from December 15 to January 15 and harvested from July to August. Sugar beets are planted from about August 15 to October 15 and harvested from the middle of May to the middle of July. Yields for sorghum are long-term yields; short-term yields are about 30 percent less.

Range Resources

About 682,500 acres in the survey area is classified as range. The area is low in elevation, and the climate is hot and dry. The elevation ranges from 700 feet in the valleys to 3,650 feet in the Estrella Mountains. Temperatures are high in summer, normally above 100° F from June until mid-September. In winter the nighttime temperature often falls to a low of 32° for about 2 months. Rainfall is 6 to 8 inches annually. Winter storms, mainly from November to March, are occasional gentle rains.

TABLE 2.—*Estimated average yields per acre under optimum management*

[Absence of yield figure indicates that the crop is not commonly grown or is not suited to the soil. Only arable soils are listed]

Soils	Cotton lint	Alfalfa	Barley	Safflower	Sugar beets	Sorghum	Citrus				
							Grapefruit	Valencia oranges	Navel oranges	Lemons	Tangerines
	Pounds	*Tons*	*Bushel*	*Tons*	*Tons*	*Bushel*	*Boxes*	*Boxes*	*Boxes*	*Boxes*	*Boxes*
Agualt loam	850	5.5	62	1.3	17	60	369	133	98	330	117
Antho gravelly sandy loam, 0 to 1 percent slopes	950	6.0	58			64	461	165	117	407	146
Antho sandy loam, 0 to 1 percent slopes	1,150	7.0	70	1.6	17	71	492	178	125	437	155
Antho sandy loam, 1 to 3 percent slopes	850	5.5	54	1.3			461	165	117	407	146
Antho sandy loam, saline-alkali	850	6.0	54			67					
Antho-Brios sandy loams	800	4.0				53					
Antho-Carrizo complex, 0 to 1 percent slopes	750	3.9					415	146	104	350	131
Avonda clay loam	900	6.0	62	1.3	16	78					
Avondale clay loam	1,200	8.0	83	1.4	25	125	492	178	125	437	155
Avondale clay loam, saline-alkali	1,000	7.0	62	1.3	18	82					
Brios loam	700	4.5	50								
Brios loamy sand	600	4.0					338	117	82	300	106
Brios sandy loam	650	4.0	41				338	117	82	300	106
Casa Grande loam	800	5.0	54	1.1	17	67					
Casa Grande sandy loam	900	5.5	58	1.1	17	67					
Casa Grande-Laveen complex, alkali	800	5.5	62			67					
Cashion clay, saline-alkali	850	6.2	58	1.0	18	100					

TABLE 2.—*Estimated average yields per acre under optimum management*—Continued

Soils	Cotton lint	Alfalfa	Barley	Safflower	Sugar beets	Sorghum	Citrus				
							Grapefruit	Valencia oranges	Navel oranges	Lemons	Tangerines
	Pounds	*Tons*	*Bushel*	*Tons*	*Tons*	*Bushel*	*Boxes*	*Boxes*	*Boxes*	*Boxes*	*Boxes*
Coolidge gravelly sandy loam, 1 to 3 percent slopes	850	5.0	------	------	------	------	461	165	117	407	146
Coolidge sandy loam	1,100	7.0	70	1.5	17	64	430	157	112	387	137
Estrella loam	1,300	9.0	75	1.7	20	107	523	186	133	462	164
Estrella loam, saline-alkali	1,000	8.0	62	1.4	15	78	------	------	------	------	------
Gadsden clay	900	6.5	62	------	20	107	------	------	------	------	------
Gadsden clay, saline-alkali	800	6.2	54	------	16	89	------	------	------	------	------
Gadsden clay loam	950	6.7	66	------	20	107	------	------	------	------	------
Gilman fine sandy loam	1,250	8.5	70	1.65	18	89	507	181	128	450	160
Gilman fine sandy loam, saline-alkali	1,000	7.0	62	1.4	------	------	------	------	------	------	------
Gilman loam, 0 to 1 percent slopes	1,350	9.0	75	1.7	20	107	523	186	133	462	164
Gilman loam, 1 to 3 percent slopes	1,000	7.5	62	------	------	------	------	------	------	------	------
Gilman loam, clayey subsoil variant, moderately saline	850	5.5	50	------	------	------	------	------	------	------	------
Gilman loam, saline-alkali	900	7.5	62	1.5	15	85	------	------	------	------	------
Glenbar clay	900	6.5	62	1.1	20	107	------	------	------	------	------
Glenbar clay loam	1,200	8.0	83	1.4	25	125	492	178	125	437	155
Glenbar clay loam, saline-alkali	900	7.5	66	1.2	------	85	------	------	------	------	------
Glenbar loam	1,300	8.5	75	1.5	22	107	507	181	128	450	160
Glenbar loam, saline-alkali	850	7.0	66	------	------	------	------	------	------	------	------
Gunsight-Rillito complex, 0 to 1 percent slopes	650	5.5	54	------	------	------	------	------	------	------	------
La Palma very fine sandy loam	700	4.0	58	------	13	------	------	------	------	------	------
Laveen clay loam	1,100	8.0	75	------	24	96	492	198	125	437	155
Laveen loam, 0 to 1 percent slopes	1,300	9.0	70	1.65	20	92	507	181	128	450	160
Laveen loam, 1 to 3 percent slopes	850	6.5	62	------	------	------	------	------	------	------	------
Laveen loam, saline-alkali	800	7.0	66	1.1	------	71	------	------	------	------	------
Laveen sandy loam	1,150	8.8	66	1.5	17	89	507	181	128	450	160
Laveen-Antho complex, saline-alkali	850	5.5	54	1.2	------	------	------	------	------	------	------
Maripo sandy loam	750	5.0	50	1.3	15	50	353	128	90	315	111
Mohall clay	900	7.0	62	1.4	20	107	------	------	------	------	------
Mohall clay loam	1,050	8.0	83	1.4	24	107	492	178	125	437	155
Mohall loam	1,200	8.5	79	1.5	20	107	492	178	125	437	155
Mohall sandy loam	1,100	7.0	79	1.45	------	89	461	165	117	407	146
Perryville gravelly loam, 0 to 1 percent slopes	950	6.0	58	1.2	13	------	------	------	------	------	------
Perryville gravelly loam, 1 to 3 percent slopes	750	5.5	45	1.0	------	------	------	------	------	------	------
Perryville loam, saline-alkali	700	5.0	50	.9	------	------	------	------	------	------	------
Perryville sandy loam	900	5.8	58	1.2	13	------	------	------	------	------	------
Pinal loam, 0 to 1 percent slopes	450	------	29	.8	------	------	------	------	------	------	------
Rillito loam, 0 to 1 percent slopes	1,050	7.2	62	1.3	------	92	492	178	125	437	155
Rillito loam, 1 to 3 percent slopes	850	6.2	------	1.1	------	------	461	165	117	407	146
Rillito sandy loam, 0 to 1 percent slopes	1,000	7.2	62	1.2	------	89	461	165	117	407	146
Rillito sandy loam, 1 to 3 percent slopes	850	6.0	58	1.0	------	------	400	141	101	350	124
Toltec loam	850	5.0	62	------	15	57	------	------	------	------	------
Tremant clay loam	950	5.5	58	1.3	17	75	461	165	117	407	146
Tremant gravelly clay loam	800	5.5	50	------	------	71	446	160	114	395	140
Tremant gravelly loam, 0 to 1 percent slopes	800	5.5	50	------	------	------	446	160	114	392	140
Tremant loam	950	5.8	58	1.4	------	75	461	165	117	407	146
Tremant-Rillito complex, 0 to 1 percent slopes	850	6.5	54	------	------	------	------	------	------	------	------
Trix clay loam	1,200	8.0	83	1.4	25	125	430	157	112	387	137
Tucson clay loam	1,100	7.8	75	1.35	22	96	430	157	112	387	137
Tucson loam	1,100	8.0	75	1.45	20	100	461	165	117	407	146
Valencia gravelly sandy loam	1,000	6.5	58	1.3	------	------	461	165	117	412	146
Valencia sandy loam	1,250	7.5	70	1.55	17	78	492	178	117	437	155
Valencia sandy loam, saline-alkali	800	7.0	66	1.3	15	71	------	------	------	------	------
Vecont clay	900	6.5	62	------	20	107	369	133	98	330	117
Vecont loam	950	6.8	70	------	------	------	------	------	------	------	------
Vint clay loam	950	6.0	70	1.4	16	64	------	------	------	------	------
Vint fine sandy loam	900	5.2	62	1.2	13	60	369	133	98	330	117
Vint loam	950	5.7	66	1.4	14	60	369	133	98	330	117
Vint loamy fine sand	750	5.0	54	1.1	------	------	369	133	98	330	117
Wintersburg complex	950	7.1	66	1.3	22	92	------	------	------	------	------

The summer season is characterized by scattered thunderstorms and heavy rainfall. Much of the precipitation received is lost to runoff and evaporation.

A wide variety of unique species occurs in the desert shrub plant community. Desert landscapes are favorites of artists and photographers. The giant saguaro, a favorite and the Arizona State flower, grows to a height of more than 50 feet and has as many as 50 arms. The largest are believed to be 150 to 200 years old.

Ironwood, a desert tree, is a climax species on the warmer Clay Upland range site. The Indians were known to use it for arrowheads because it is hard, brittle, and heavy.

One of the oldest and most conspicuous plants of the area is the ocotillo, sometimes called coachwhip. In dry weather it drops its leaves, but refoliates immediately after a good rain and develops an attractive red flower.

Jumping cholla cactus is another unique plant found on the warm slopes. Its dense, barbed spines are on easily detached joints. Painful and persistent barbs are the consequence of brushing too close to this plant.

Most of the desert plants played a very important role in the lives of the Indians who lived in the area. Plants were used for food, medicine, shelter, tools, weapons, and fuel. They were also used in ornaments, dyes and paints, gums and adhesives, soap, musical instruments, insect traps, perfumes, and baskets and in games and ceremonial rites.

The area provides habitat for several important desert wildlife species, including the rare and endangered desert bighorn sheep. Other wildlife species using the area are desert mule deer, javelina, Gambel quail, mourning and white-winged doves, rabbits, and numerous songbirds.

Soils of the area vary widely in depth and texture. Those in the valleys range from shallow to deep. The surface layer is medium textured to coarse textured. The subsoil is somewhat finer textured. Steep soils on the hills and mountains are shallow, rocky, and coarse textured. Soils of the Loamy Upland range site have a desert varnished gravel pavement and an indurated hardpan. The salt content ranges from low to high, and reaction ranges from moderate to strongly alkaline. Both strongly influence the vegetation on the Saline Upland range site.

Grazing

At one time this area produced more abundant amounts of desirable perennial forage species, especially such grasses as bush muhly (hoegrass), plains bristlegrass, Arizona cottontop, and slim tridens. As livestock increased, the highly preferred plants decreased and bush muhly now is only found where it is protected by unpalatable shrubs. The others are nearly absent.

Plants of little or no grazing value, mostly shrubs and trees, have increased and make up most of the perennial composition. Perennial plants of grazing value are big galleta, four-wing saltbush, range ratany, and a trace of bush muhly.

Present grazing of the area is administered by the Bureau of Land Management on a yearlong permit basis. Future plans are to issue permits on an ephemeral use basis because grazing in most of the area is entirely dependent on the production of annuals, such as Indianwheat and filaree. Most of the permittees are absentee operators who use the range to graze steers.

Practices that can improve range in this survey area are those that benefit management rather than mechanical treatment and reseeding. Fencing and development of stockwater facilities that help proper grazing and planned grazing systems can be most beneficial. Water spreading to make wider use of runoff could be beneficial in some areas.

Mechanical treatment and reseeding of range is possible. Low rainfall, hazardous soil conditions, and high cost, however, make the feasibility of these practices questionable.

Range sites and condition classes

Soils are grouped into range sites according to their capacity to produce the same kinds, amounts, and proportions of range plants. A range site is the product of all environmental factors responsible for its development.

A plant community existing within a range site that has not undergone abnormal disturbance is the potential, or climax, plant community for that site. Climax plant communities are not precise or fixed in their composition, but vary, within reasonable limits, from year to year and from place to place.

Abnormal disturbance, such as overuse by livestock, excessive burning, erosion, or plowing, results in changes in the climax plant community or even complete destruction if disturbance is drastic enough. If the range site has not deteriorated significantly under such disturbance, secondary plant succession progresses in the direction of the natural potential or climax plant community for the site.

Four range condition classes are used to indicate the degree of departure from the potential, or climax, vegetation brought about by grazing or other uses. The classes show the present condition of the native vegetation on a range site in relation to the native vegetation that could grow there.

A range is in *excellent* condition if 76 to 100 percent of the vegetation is of the same kind as that in the climax stand. It is in *good* condition if the percentage is 51 to 75; in *fair* condition if the percentage is 26 to 50; and in *poor* condition if the percentage is less than 25.

When changes occur in the climax plant community as a result of livestock grazing or disturbance, some plant species increase and others decrease. By comparing the composition of the present plant community to the climax plant community, it is possible to see to what extent the plant cover has deteriorated. Invaders are weeds and forbs that are not part of the climax community, but invade and are conspicuous in the present plant community.

The composition of climax and present plant communities and other range site information provide the basis for selecting the kind of management needed.

A good range management program is designed to increase desirable plants and restore the range to as near climax condition as possible. Some programs are designed to create or maintain plant communities somewhat removed from the climax to fit specific needs in the grazing program, to provide for wildlife habitat, or for other benefits. All management objectives should be compatible with conservation objectives.

Descriptions of range sites

On the following pages, six range sites of the survey area are described, and the climax plants and principal invaders on the sites are listed. Only limited data are available concerning the kinds and amounts of climax vegetation that can be expected, but an estimate is given of the potential annual yield of air-dry vegetation for each site when it is in excellent condition. It is recognized that small areas at the higher elevations of the desert mountains receive annual precipitation in excess of 8 inches per year and are somewhat lower in temperature. These areas are minor in extent and are included with the adjacent range sites. The soils in each site can be determined by referring to the "Guide to Mapping Units" at the back of this soil survey.

CLAY UPLAND RANGE SITE

This site is on old alluvial fans, mainly at the base of the White Tank, Estrella, and Salt River Mountains. In these positions this site has good air drainage and is slightly warmer than other sites in winter. The total extent of this site is about 16,000 acres. Slopes are 0 to 10 percent.

The soils have a gravelly or very gravelly sandy loam, loam, or clay loam surface layer and a gravelly or very gravelly clay loam, sandy clay loam, or clay subsoil.

Permeability is moderately slow to slow. Runoff is medium.

Potential production on this site is 500 pounds of air-dry herbage per acre in favorable years and 150 pounds in unfavorable years. Bursage and creosotebush increase as the range deteriorates. The more palatable plants, such as bush muhly, have almost disappeared.

Following are the kinds and amounts of potential vegetation.

Species:	Percent	Species:	Percent
Bush muhly	5–10	Saguaro	0–3
Triangle bursage	30–50	Barrel cactus	0–1
Creosotebush	5–20	Rabbitbrush	0–3
Littleleaf paloverde	0–5	Range ratany	5–10
Mesquite	0–5	Mormon-tea	0–3
Staghorn cholla	0–5	Brickellia	0–3
Ironwood	0–3	Cactus	0–3
Ocotillo	0–3	Native annuals	5–10
Jumping cholla	0–3		

SALINE UPLAND RANGE SITE

This range site is on valley plains, flood plains, and low terraces and at the lower ends of alluvial fans that are mainly along the margins of Centennial and Luke Washes. The total extent is about 30,000 acres. Slopes are generally less than 1 percent, but range to nearly 8 percent.

The soils are saline and alkali sandy loams through clay loams. Some are gravelly throughout.

Permeability ranges from moderately rapid to slow. Runoff is ordinarily very slow to medium, but rainfall from violent summer storms runs off at a rapid rate.

Potential production on this range site is 600 pounds of air-dry herbage per acre in favorable years and 300 pounds in unfavorable years. The preferred forage species are restricted to drainageways where they are protected by unpalatable shrubs. Desert saltbrush, mesquite, and creosotebush have increased on this site.

Following are the kinds and amounts of potential vegetation.

Species:	Percent	Species:	Percent
Bush muhly	10–15	Cactus	5–10
Plains bristlegrass	5–10	Blue paloverde	0–5
Arizona cottontop	5–10	Catclaw	0–5
Three-awns	5–10	Desert broom	0–5
Desert saltbush	30–50	Wolfberry	0–5
Mesquite	5–10	Graythorn	0–5
Creosotebush	5–15	Fluffgrass	0–2
Four-wing saltbush	5–15	Native annuals	0–10

SANDY BOTTOM RANGE SITE

This site is in stream channels and on flood plains and the adjacent low stream terraces along the major streams. A major part along the Gila River has been designated as the J. Fred Weiler Green Belt. The water table in this area fluctuates between depths of 4 and 25 feet and consequently affects the vegetation. This area also receives additional moisture from occasional flooding, from tailwater of irrigation districts, and from sewage disposal plants. Other areas of this site, chiefly along the Salt, Agua Fria, and Hassayampa Rivers, receive additional moisture only during the occasional floods. The total extent of this site is about 25,000 acres.

The soils have a sand to loam surface layer and sand to loamy fine sand lower layers. They contain varying amounts of gravel and cobbles.

Permeability is moderately rapid to rapid. Runoff is slow to very slow. Most areas of this range site are subject to rare flooding.

Potential production on this range site is 1,000 pounds of air-dry herbage per acre in favorable years and 500 pounds in unfavorable years. Potential production in areas receiving additional moisture from a high water table is in excess of 1,000 pounds per acre. Deterioration has caused palatable forage species to be found only where they are protected by unpalatable shrubs. Four-wing saltbush and mesquite have increased on this site. The part of this site along the Gila River where the water table is high now supports a nearly solid stand of saltcedar.

Following are the kinds and amounts of potential vegetation.

Species:	Percent	Species:	Percent
Bush muhly	10–15	Wolfberry	0–5
Plains bristlegrass	0–5	Lenscale	0–5
Arizona cottontop	0–5	Annuals	5–10
Three-awn	10–20	Fluffgrass	0–3
Four-wing saltbush	30–50	Saltcedar	0–50
Creosotebush	0–5	Arrowweed	0–3
Mesquite	10–15	Pickleweed	0–3
Desert broom	0–5	Inkweed	0–3
Desert saltbush	0–5		

LOAM UPLAND RANGE SITE

This site is on alluvial fans, valley plains, and stream terraces throughout the survey area. The total extent of this site is about 489,000 acres. Slopes range from 0 to 20 percent.

The soils vary widely. Most soils are deep and relatively free of salt or alkali, but a few are underlain by an indurated hardpan at a depth of less than 20 inches. Several areas are gravelly.

Potential production on this range site is 1,000 pounds of air-dry herbage per acre in favorable years and 500 pounds in unfavorable years. Deterioration has caused

the more palatable forage species to have almost disappeared. Creosotebush has increased and is dominant.

The following are the kinds and amounts of potential vegetation.

Species:	Percent	Species:	Percent
Bush muhly	5–10	Littleleaf paloverde	0–5
Big galleta	15–30	Triangle bursage	0–5
Plains bristlegrass	0–5	White bursage	0–5
Arizona cottontop	0–5	Staghorn cholla	0–5
Range ratany	5–10	Graythorn	0–5
Creosotebush	10–50	Saguaro	0–5
Three-awn	10–25		

LOAM HILLS RANGE SITE

This site is on low hills and mountain ranges, including the Estrella, Salt River, Eagletail, and White Tank Mountains. Although bedrock exposures that have 15 to 80 percent slopes are not in this site, they influence runoff. The total extent of this site is about 120,000 acres.

The soils are very gravelly very fine sandy loams to very gravelly clay loams that are less than 20 inches deep over bedrock. Some areas are cobbly and others are stony.

Permeability is moderate to moderately slow. Runoff is medium in some areas, but is rapid in areas where bedrock is exposed.

Potential production on this range site is 800 pounds of air-dry herbage per acre in favorable years and 200 pounds in unfavorable years. This site has not deteriorated as much as other range sites because it is inaccessible to livestock grazing.

Following are the kinds and amounts of potential vegetation.

Species:	Percent	Species:	Percent
Bush muhly	10–15	Four-wing saltbush	5–15
Desert needlegrass	5–10	Brittlebush	5–10
Slender tridens	0–5	Big galleta	15–30
Arizona cottontop	0–5	Three-awn	5–10
Black grama	5–10	Mormon-tea	5–10
Dropseed	5–10	Annuals	0–25
Range ratany	10–15		

CLAY BOTTOM RANGE SITE

This range site is in the area north of Sun City and at the northeast end of the White Tank Mountains. It is in slightly concave swales in old valley plains, stream terraces, and alluvial fans. Slopes are less than 1 percent. The total extent is about 2,500 acres.

The soils have a loam to clay surface layer and a clay subsoil. Some have an indurated hardpan at a depth of less than 40 inches.

Permeability is slow. Runoff is slow, but runoff from adjacent areas supplements the natural rainfall.

Potential production on this range site is 800 pounds of air-dry herbage per acre in favorable years and 400 pounds in unfavorable years. As the palatable plants decrease on this site, big galleta, mesquite, and creosotebush increase.

Following are the kinds and amounts of potential vegetation.

Species:	Percent	Species:	Percent
Bush muhly	0–10	Triangle bursage	0–5
Plains bristlegrass	0–5	Creosotebush	5–10
Arizona cottontop	0–5	Three-awn	0–5
Big galleta	40–70	Fluffgrass	0–3
Mesquite	5–20	Cactus	0–5
Littleleaf paloverde	0–5	Native annuals	0–25

Managing Soils for Wildlife [4]

Table 3 lists wildlife species represented in the survey area and the kind of habitat required for each.

TABLE 3.—*Wildlife species and habitat*

[× means minor importance. ×× means major importance]

Representative species of wildlife	Kind of habitat required			
	Openland		Wetland	Rangeland
	Irrigated	Dryland		
Javelina		×		××
Desert mule deer		×	×	××
Bobcat	×	×	×	×
Coyote	×	×	×	××
Gray fox	×	×	×	×
Kit fox	×	×	×	××
Mexican racoon	××	×	××	
Ringtail		×	×	××
Coati		×	×	××
Badger		×		××
Desert cottontail	×	××	××	××
Kangaroo rat		××		××
White-winged dove	××		××	
Mourning dove	××	××	××	××
Gambel quail	×	××	×	××
Roadrunner	×	×	×	××
Elf owl		×		××
Sidewinder rattlesnake		×		××
Banded gecko		×		××
Chuckwalla				××
Desert tortoise		×	×	××
Colorado River toad	××	×	××	×

Soils directly affect the kind and amount of vegetation that is available to wildlife as food and cover, and they affect the construction of water impoundments. The kind and abundance of wildlife that populate an area depend largely on the amount and distribution of food, cover, and water. If any one of these elements is missing, inadequate, or inaccessible, wildlife either are scarce or do not inhabit the area.

If the soils have the potential, wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by helping the natural establishment of desirable plants.

In table 4 the soils in the survey area are rated, by soil groups, according to their potential to support the main kinds of wildlife habitat in the area. This information can be used in planning for parks, wildlife refuges, nature study areas, and other developments for wildlife; selecting areas that are suitable for wildlife; selecting soils that are suitable for creating, improving, or maintaining specific elements of wildlife habitat; and determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* means that the element of wildlife habitat or the kind of habitat is easily created,

[4] JOHN YORK, biologist, Soil Conservation Service, helped prepare this section.

improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected if the soil is used for the designated purpose. A rating of *fair* means that the element of wildlife habitat or kind of habitat can be created, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* means that limitations are severe for the designated element or kind of wildlife habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* means that restrictions for the element of wildlife habitat or kind of wildlife are very severe, and that unsatisfactory results can be expected. Wildlife habitat is impractical or even impossible to create, improve, or maintain on soils having such a rating.

The elements of wildlife habitat are briefly described in the following paragraphs.

Grain and seed crops are seed-producing annuals used by wildlife. Examples are corn, wheat, oats, barley, safflower, and sunflowers. The major soil properties that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations.

Grasses and legumes are domestic perennial grasses and herbaceous legumes that are planted for wildlife food and cover. Examples are fescue, bush muhly, lovegrass, Arizona cottontop, catclaw, clover, alfalfa, and trefoil. Major soil properties that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds, that provide food and cover for wildlife. Examples are bluestem, beggarweed, pokeweed, wheatgrass, fescue, and grama. Major soil properties that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, or foliage used by wildlife or that provide cover and shade for some species of wildlife. Examples are fourwing saltbush, creosotebush, and bursage. Major soil properties that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and moisture.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites, exclusive of submerged or floating aquatics. They produce food or cover for wildlife that use wetland as habitat. Examples of wetland plants are wild millet, wildrice, saltgrass, cattail, rushes, and sedges. Major soil properties affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness.

Shallow water areas are bodies of water that have an average depth of less than 5 feet and that are useful to wildlife. They can be naturally wet areas, or they can be created by dams or levees or by water-control devices in marshes or streams. Examples are marshes, waterfowl feeding areas, and ponds. Major soil properties affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. The availability of a dependable water supply is important if water areas are to be developed.

The kinds of wildlife habitat are briefly described in the following paragraphs.

Openland habitat consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The kinds of wildlife attracted to these areas include Gambel quail, roadrunner, mourning dove, white-winged dove, Mexican raccoon, and Colorado River toad.

Wetland habitat consists of open, marshy or swampy, shallow-water areas where water-tolerant plants grow. Some of the wildlife attracted to such areas are Mexican raccoon, desert cottontail, white-winged dove, mourning dove, and Colorado River toad.

Rangeland habitat consists of areas of wild herbaceous plants and shrubs. Wildlife attracted to rangeland include Mexican raccoon, desert cottontail, white-winged dove, mourning dove, and Colorado River toad.

Wildlife habitat groups

Soils of the survey area have been assigned to 14 wildlife habitat groups according to their potential for producing three types of habitat for native wildlife.

Soils in the first eight groups, as indicated in table 4, are in areas where irrigation water is available. The rating for shallow water areas is based on the assumption that water is available near the site to create artifical ponds. Permeability is the most important factor in this rating. Soils in the last six groups are in areas where no irrigation water is available or they are not suitable for cultivation. The rating for shallow water areas on these soils is based on rainfall only. Soil drainage is the most critical factor in this rating. Only a few areas along the Gila River are suitable as wetland. Some soils occur in both the irrigated and dryland areas. These soils will appear in both the irrigated and dryland groups.

WILDLIFE HABITAT GROUP 1

The soils in this group are on stream terraces, alluvial fans, and valley plains. They are good for openland wildlife and poor for wetland wildlife. They are deep and well drained and are moderately to moderately slowly permeable. All are irrigated. Some are underlain by sand or loamy sand below a depth of 20 inches. Others have a slowly permeable pan below a depth of 20 inches. Slopes range from 0 to 3 percent.

The average annual rainfall is 6 to 8 inches. The available water capacity is from 6 to 13 inches. The mean annual air temperature is 68° to 74° F, and the frost-free season is 250 to 300 days. The vegetation is mainly cotton, alfalfa, barley, sorghum, and safflower.

TABLE 4.—*Suitability of soils, by soil groups, for wildlife habitat*

Wildlife habitat suitability groups	Potential for habitat elements						Potential for kinds of habitat		
	Grain and seed crops	Grass and legume crops	Wild herbaceous plants	Shrubs	Wetlands plants	Shallow water	Openland	Wetland	Rangeland
	IRRIGATED SOILS								
Group 1	Good	Good	Good	Good	Poor	Fair	Good	Poor.	
Group 2	Good	Good	Good	Good	Poor	Very poor	Good	Very poor.	
Group 3	Fair	Fair	Fair	Fair	Poor	Good	Fair	Fair.	
Group 4	Fair	Fair	Fair	Fair	Poor	Very poor	Fair	Very poor.	
Group 5	Fair	Fair	Fair	Fair	Very poor	Good	Fair	Poor.	
Group 6	Poor	Poor	Poor	Poor	Poor	Very poor	Poor	Very poor.	
Group 7	Poor	Poor	Poor	Poor	Poor	Poor	Poor	Poor.	
Group 8	Poor	Poor	Poor	Poor	Poor	Good	Poor	Fair.	
	DRYLAND SOILS								
Group 9			Fair: good in places in Gila River.	Fair: good in places in Gila River.	Very poor: good in places in Gila River.	Very poor: in good places in Gila River.		Very poor: good in places in Gila River.	Fair: good in places in Gila River.
Group 10			Poor	Fair	Very poor	Very poor		Very poor	Poor.
Group 11			Poor	Poor	Poor	Very poor		Very poor	Poor.
Group 12			Poor	Poor	Very poor	Very poor		Very poor	Poor.
Group 13			Very poor	Very poor	Poor	Very poor		Very poor	Poor.
Group 14			Very poor	Very poor	Very poor	Very poor		Very poor	Very poor.

Important wildlife species are jackrabbits, cottontail rabbits, skunks, mourning dove, white-winged dove, Gambel quail, and songbirds.

WILDLIFE HABITAT GROUP 2

The soils in this group are on alluvial fans, valley plains, and stream terraces. They are good for openland wildlife and very poor for wetland wildlife. They are deep and well drained and are moderately rapidly permeable. All are irrigated. The surface layer is sandy loam, fine sandy loam, or loam. The underlying material ranges from loamy fine sand to loam. In some places the soils have gravelly lower layers, and in some they contain concentrations of lime. Slopes range from 0 to 3 percent.

The average annual rainfall is 6 to 8 inches. The available water capacity is 5.0 to 7.5 inches. The mean annual air temperature is 68° to 74° F, and the frost-free season is 250 to 300 days. The vegetation is mainly cotton, alfalfa, barley, sorghum, safflower, and sugar beets.

Important wildlife species are jackrabbits, cottontail rabbits, mourning dove, white-winged dove, Gambel quail, skunks, and songbirds.

WILDLIFE HABITAT GROUP 3

Most of the soils in this group are on flood plains, low stream terraces, and valley plains adjacent to stream channels. They are fair for openland wildlife and wetland wildlife. All are deep and well drained and are slowly to moderately slowly permeable. Most have a surface layer of clay loam or clay, but a few are loam. The lower layers range from loam to clay. Some soils contain lime concentrations. Slopes are less than 1 percent.

The average annual rainfall is 6 to 8 inches. The available water capacity is 8 to 13 inches. The mean annual air temperature is 68° to 74° F, and the frost-free season is 250 to 300 days. Some of these soils are subject to flooding. The vegetation is mainly cotton, alfalfa, barley, sorghum, safflower, and sugar beets.

Some of the important wildlife species are jackrabbits, cottontail rabbits, skunks, rodents, white-winged dove, mourning dove, Gambel quail, and songbirds.

WILDLIFE HABITAT GROUP 4

The soils in this group are on alluvial fans, flood plains, and low stream terraces along major streams. They are fair for openland wildlife and very poor for wetland wildlife. They are deep and well drained and are rapidly to moderately rapidly permeable. The surface layer ranges from loamy fine sand to sandy loam, and the lower layers range from sand to sandy loam. Slopes range from 0 to 1 percent.

The average annual rainfall is 6 to 8 inches. The available water capacity is 4 to 7 inches. The mean annual air temperature is 69° to 74° F, and the frost-free season is 250 to 300 days. Some areas are subject to flooding. The vegetation is mainly cotton, alfalfa, sorghum, barley, wheat, and safflower.

Some of the important wildlife species are jackrabbit, cottontail rabbit, rodents, skunk, mourning dove, white-winged dove, Gambel quail, and songbirds.

WILDLIFE HABITAT GROUP 5

The soils in this group are on valley plains and alluvial fans. They are fair for openland wildlife and poor for wetland wildlife. They are deep, well drained, and saline-

alkali. The surface layer ranges from sandy loam to loam. The lower layers range from loam to clay loam. All soils contain excessive amounts of saline or alkali salts or both and have visible concentrations of lime. Some are underlain by a hardpan, which is below a depth of 20 inches. Slopes are less than 1 percent.

The average annual rainfall is 6 to 8 inches. The available water capacity is 3 to 8 inches. The mean annual air temperature is 67° to 74° F, and the frost-free season is 250 to 300 days. The vegetation is mainly cotton, alfalfa, barley, sorghum, and safflower.

Some of the important wildlife species are jackrabbits, cottontail rabbits, rodents, skunks, mourning dove, white-winged dove, Gambel quail, and songbirds.

WILDLIFE HABITAT GROUP 6

The soils in this group are poor for openland wildlife and very poor for wetland wildlife. They are deep and well drained to excessively drained and are rapidly permeable. The surface layer ranges from loamy sand to gravelly sandy loam, and the lower layers range from very gravelly sand to sand. Slopes range from 0 to 1 percent.

The average annual rainfall is 6 to 8 inches. The available water capacity is 2 to 5 inches. The mean annual air temperature is 69° to 74° F, and the frost-free season is 250 to 300 days. Some areas are subject to frequent flooding. Vegetation is mainly cotton, alfalfa, and small grain.

Some of the important wildlife species are jackrabbits, cottontail rabbits, rodents, mourning dove, white-winged dove, Gambel quail, and songbirds.

WILDLIFE HABITAT GROUP 7

The soils in this group are poor for openland wildlife and wetland wildlife. Some are deep and well drained, are moderately rapidly to moderately permeable, and have a gravelly loam surface layer and gravelly loam or very gravelly loam lower layers. Others are less than 20 inches deep over an impermeable hardpan. Slopes range from 0 to 1 percent.

The average annual rainfall is 6 to 8 inches. The available water capacity is 1 to 4 inches. The mean annual air temperature is 68° to 74° F, and the frost-free season is 250 to 320 days. Vegetation is mainly cotton, alfalfa, barley, and safflower.

Some of the important wildlife species are jackrabbits, cottontail rabbits, skunks, rodents, Gambel quail, mourning dove, white-winged dove, and songbirds.

WILDLIFE HABITAT GROUP 8

The soils in this group are on flood plains and low stream terraces. They are poor for openland wildlife and fair for wetland wildlife. They are deep and well drained and are slowly permeable. They are mainly clays, but are underlain at a depth of 20 to 40 inches by silt loam in places. They contain excessive amounts of saline or alkali salts or both. Slopes are 0 to 1 percent.

The average annual rainfall is 6 to 8 inches. The available water capacity is 9 to 10 inches. The mean annual air temperature is 60° to 74° F, and the frost-free season is 250 to 300 days. The vegetation is mainly cotton, alfalfa, sorghums, barley, and sugar beets.

Important wildlife species are jackrabbit, cottontail rabbit, skunks, rodents, mourning dove, white-winged dove, Gambel quail, roadrunners, and songbirds.

WILDLIFE HABITAT GROUP 9

The soils in this group are on old alluvial fans, stream terraces, and flood plains and in stream channels. They are generally very poor for wetland wildlife and fair for rangeland wildlife, but in some areas along the Gila River they provide good wetland and rangeland habitat. They are deep, well-drained to excessively drained very gravelly sands to clays. Some have a hardpan at a depth of 20 to 40 inches. None are irrigated. Slopes are less than 1 percent.

The average annual rainfall is 6 to 8 inches, but most soils receive some additional runoff. The mean annual temperature is 69° to 74° F, and the frost-free season is 250 to 300 days. The water table is above a depth of 5 feet in a few places along the Gila River. The vegetation along the Gila River is saltcedar, arrowweed, saltbush, creosotebush, and mesquite. Vegetation on the old alluvial fans is galleta, mesquite, littleleaf paloverde, triangle bursage, and creosotebush.

Some of the important wildlife species are jackrabbits, cottontail rabbits, mourning dove, white-winged dove, Gambel quail, kangaroo rats, Colorado River toads, lizards, and songbirds. The Fred J. Weiler Green Belt on these soils is considered a most important nesting and roosting habitat for white-winged dove.

WILDLIFE HABITAT GROUP 10

The soils in this group are on alluvial fans, flood plains, and low terraces and in stream channels. They are very poor for wetland wildlife and poor for rangeland wildlife. They are deep and well drained to excessively drained. The surface layer ranges from sandy loam to loam and contains variable amounts of gravel. The lower layers range from sand to sandy loam and also contain variable amounts of gravel. None of the soils are irrigated. Slopes are 0 to 3 percent.

The average annual rainfall ranges from 6 to 8 inches. The mean annual air temperature ranges from 69° to 74° F, and the frost-free season from 250 to 300 days. The vegetation is mainly creosotebush, mesquite, littleleaf paloverde, bursage, and staghorn cholla cactus.

Important wildlife species are jackrabbits, cottontail rabbits, coyotes, roadrunners, sidewinder rattlesnakes, chuckwalla, kangaroo rats, desert mule deer, and songbirds.

WILDLIFE HABITAT GROUP 11

The soils in this group are very poor for wetland wildlife and poor for rangeland wildlife. They are highly variable. Most are deep and well drained, but a few are shallow over a hardpan. The surface layer ranges from loamy sand to clay, but in places is gravelly. The lower layers range from sand to clay and contain variable amounts of gravel. Some soils contain concentrations of lime, and others contain excessive amounts of saline or alkali salts or both. None are irrigated. Slopes range from 0 to 12 percent.

Annual precipitation is 6 to 8 inches. Few areas receive any supplemental water from flooding. The mean annual temperature is 68° to 74° F, and the frost-free season is 250 to 320 days. The vegetation is creosotebush, littleleaf paloverde, triangle bursage, white bursage, and cactus.

Important wildlife species are jackrabbits, kangaroo rats, coyotes, roadrunners, sidewinder rattlesnakes, banded gecko, chuckwalla, desert tortoise, and songbirds.

WILDLIFE HABITAT GROUP 12

Some of the soils in this group are on low hills and mountains, and others are in or near stream channels. All are very poor for wetland wildlife and poor for rangeland wildlife. Some are deep and well drained to excessively drained, and others are shallow over bedrock. The surface layer ranges from loamy sand to clay loam and contains variable amounts of gravel and cobbles. The lower layers range from sand to loam and also contain variable amounts of gravel and cobbles. None of the soils are irrigated. Slopes range from 0 to 90 percent.

The annual rainfall is 6 to 8 inches. The mean annual air temperature is 69° to 74° F, and the frost-free season is 250 to 325 days. Vegetation is mainly creosotebush, range ratany, triangle bursage, white bursage, joint fir, bladdersage, paloverde, wolfberry, and cactus.

Important wildlife species are jackrabbits, coyote, chuckwalla, elf owl, desert mule deer, javelina, bobcat, kit fox, gray fox, and songbirds.

WILDLIFE HABITAT GROUP 13

The soils in this group are on alluvial fans, stream terraces, and valley plains. They are very poor for wetland wildlife and poor for rangeland wildlife. They are deep, well drained, and saline-alkali. The surface layer ranges from sandy loam to clay loam, and the lower layers range from sandy loam to clay. All soils contain excessive amounts of saline or alkali salts or both, and some have lime concentrations. Some have a hardpan at a depth ranging from 10 to 40 inches. None are irrigated. Slopes range from 0 to 3 percent.

The annual rainfall is 6 to 8 inches. Few areas receive any additional moisture from flooding. The mean annual air temperature is 68° to 74° F, and the frost-free season is 250 to 300 days. The vegetation is saltbush, arrowweed, creosotebush, paloverde trees, and cactus.

Some of the important wildlife species are jackrabbits, bannertail kangaroo rats, roadrunners, chuckwalla, sidewinder rattlesnakes, and songbirds.

WILDLIFE HABITAT GROUP 14

The soils in this group are very poor for wetland wildlife and rangeland wildlife. They are deep, well drained, and saline-alkali. They have a sandy loam to clay loam surface layer and loam to clay loam lower layers. Some have gravel on the surface and in the lower layers. Others have a hardpan below a depth of 20 inches. All contain excessive amounts of saline or alkali salts or both and have concentrations of lime at or near the surface. None are irrigated. Slopes range from 0 to 8 percent.

Annual precipitation is 6 to 8 inches. The mean annual air temperature is 67° to 74° F, and the frost-free season is 250 to 300 days. The vegetation is mainly saltbush, creosotebush, mesquite, and cactus.

Important wildlife species are jackrabbits, roadrunners, bannertail kangaroo rats, sidewinder rattlesnakes, banded gecko, and songbirds.

Engineering Uses of the Soils [5]

This section is useful to those who need information about soils used as structural material or as foundation upon which structures are built. Among those who can benefit from this section are planning commissions, town and city managers, land developers, engineers, contractors, farmers, and individual land owners.

Among properties of soils highly important in engineering are permeability, strength, compaction characteristics, drainage condition, shrink-swell potential, grain size, plasticity, and reaction. Also important are depth to the water table, depth to bedrock, and slope. These properties, in various degrees and combinations, affect construction and maintenance of roads, airports, pipelines, foundations for small buildings, irrigation systems, ponds and small dams, and systems for disposal of sewage and refuse.

Information in this section of the soil survey can be helpful to those who—

1. Select potential residential, industrial, commercial, and recreational areas.
2. Evaluate alternate routes for roads, highways, pipelines, and underground cables.
3. Seek sources of gravel, sand, or clay.
4. Plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for controlling water and conserving soil.
5. Correlate performance or structures already built with properties of the kinds of soil on which they are built, for the purpose of predicting performance of structures on the same or similar kinds of soil in other locations.
6. Predict the trafficability of soils for cross-country movement of vehicles and construction equipment.
7. Develop preliminary estimates pertinent to construction in a particular area.

Most of the information in this section is presented in tables 5 and 6, which show, respectively, several estimated soil properties significant in engineering and interpretations for various engineering uses. This information, along with the soil map and other parts of this publication, can be used to make interpretations in addition to those given in the tables, and it also can be used to make other useful maps.

This information, however, does not eliminate need for further investigations at sites selected for engineering works, especially works that involve heavy loads or that require excavations to depths greater than those shown in the tables, generally a depth of more than 6 feet. Also, inspection of sites, especially the small ones, is needed because many delineated areas of a given soil mapping unit may contain small areas of other kinds of soil that have strongly contrasting properties and different suitabilities or limitations for soil engineering.

Some terms in this soil survey have special meaning in soil science that may not be familiar to engineers. The Glossary defines many terms commonly used in soil science.

Engineering soil classification systems

The two systems most commonly used in classifying samples of soils for engineering are the Unified system used by the SCS engineers, Department of Defense, and others, and the AASHTO system adopted by the American Association of State Highway and Transportation Officials.

[5] JAMES KOSAR, JR., engineer, Soil Conservation Service, helped prepare this section.

TABLE 5.—*Estimates of soil properties*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil that may that appear in the first column.

Soil series and map symbols	Hydrologic group	Depth from surface	Dominant USDA texture	Classification		Coarse fraction greater than 3 inches in diameter
				Unified	AASHTO	
		Inches				
Agualt:[1] Aa	B	0–27	Loam	ML	A–4	0
		27–60	Sand	SP	A–3	0
*Antho: AbA, AbB, AdA, AdB, Ae, AfA, AfB, AGB, AHC, AkB, AL, AM. For Brios part of Ae; Carrizo part of AfA, AfB, AGB; Tremant part of AHC, AkB; Mohall part of AkB; and Valencia part of AM; see their respective series.	B	0–60	Sandy loam or gravelly sandy loam.	SM	A–2	0
Ac	B	0–60	Sandy loam or gravelly sandy loam.	SM	A–2 or A–4	0
Avonda: An	B	0–13	Clay loam	CL	A–6	0
		13–27	Loam	ML	A–4	0
		27–60	Loamy coarse sand	SP or SM	A–3	0
Avondale: Ao	B	0–12	Clay loam	CL	A–6	0
		12–60	Loam	ML	A–4	0
Ap	B	0–12	Clay loam	CL	A–6	0
		12–60	Loam	ML	A–4	0
Beardsley: BE	C	0–36	Clay	CH	A–7	0
		36	Indurated silica-lime cemented hardpan.			
Brios:[1] Br, Bs, Bt	A	0–14	Sandy loam	SM	A–2	0
		14–60	Sand and gravelly sand	SP	A–1	0–5
*Calciorthids: CA2. For Torriorthents part, see Torriorthents. Too variable to be estimated.						
*Carrizo:[1] Cb, CeD, CF	A	0–5	Gravelly sandy loam	SM	A–1 or A–2	0–25
For Ebon part of CeD and Brios part of CF, see their respective series.		5–60	Very gravelly coarse sand	GW–GM, SW–SM	A–1	0–25
*Casa Grande: Cg, Ch, Ck, Cm. For Laveen part of Cm, see Laveen series.	C	0–23	Clay loam	CL	A–6	0
		23–60	Loam and sandy loam	ML	A–4	0
Cashion: Cn	D	0–27	Clay	CL or CH	A–7 or A–6	0
		27–60	Loam, silt loam, and very fine sandy loam.	ML	A–4	0
*Cherioni: CO	D	0–6	Very gravelly loam	GM	A–1 or A–2	0–15
No valid estimate can be made for Rock outcrop part.		6–12	Silica-lime cemented hardpan bedrock.			
*Coolidge: Cp, CrB, Cs, CV	B	0–24	Sandy loam	SM	A–2	0
For Tremant part of Cs and Laveen part of CV, see their respective series.		24–60	Sandy loam	SC	A–2 or A–4	0
Dune land: Dn. No valid estimate can be made.						
*Ebon: EbD, EPD	C	0–38	Very cobbly clay	GC or CH	A–2 or A–7	30–85
For Pinamt part, see Pinamt series.		38–60	Very cobbly sandy clay loam.	GC	A–2	30–55

See footnotes at end of table.

significant in engineering

have different properties and limitations. For this reason it is necessary to follow carefully the instructions for referring to other series The symbol > means more than]

Percentage of material less than 3 inches in diameter passing sieve—				Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential	Risk of corrosion to—	
No. 4	No. 10	No. 40	No. 200								Uncoated steel	Concrete
						Inches per hour	*Inches per inch of soil*	*pH*	*Millimhos per centimeter*			
-------	100	85–95	55–65	25–35	0–5	0. 6–2. 0	0. 15–0. 18	7. 9–8. 4	1–2	Low------	High------	Low.
95–100	85–95	55–65	0–3	-------	[2]NP	>20. 0	0. 05–0. 07	7. 9–8. 4	1–2	Low------	High------	Low.
80–100	50–75	50–60	15–30	-------	NP	2. 0–6. 0	0. 08–0. 12	7. 9–8. 4	1–2	Low------	High------	Low.
80–100	50–75	50–60	15–30	-------	NP	2. 0–6. 0	0. 08–0. 12	8. 5–9. 0	4–8	Low------	High------	High.
-------	100	90–100	70–80	30–35	11–15	0. 2–0. 6	0. 19–0. 20	7. 9–8. 4	1–2	Moderate--	High [3]-----	Low.
-------	100	95–100	55–65	25–35	NP–10	0. 6–2. 0	0. 15–0. 17	7. 9–8. 4	1–2	Low------	High------	Low.
85–95	75–90	55–65	0–10	-------	NP	6. 0–20. 0	0. 05–0. 07	7. 9–8. 4	1–2	Low------	High------	Low.
-------	100	90–100	70–80	30–35	11–15	0. 2–0. 6	0. 19–0. 21	7. 9–8. 4	1–2	Moderate--	High [3]-----	Low.
-------	100	85–95	55–65	25–35	NP–5	0. 6–2. 0	0. 15–0. 17	7. 9–8. 4	1–2	Low------	High------	Low.
-------	100	90–100	70–80	30–35	11–15	0. 2–0. 6	0. 19–0. 21	7. 9–8. 4	4–40	Moderate--	High------	High.
-------	100	85–95	55–65	25–35	NP–5	0. 6–2. 0	0. 15–0. 17	7. 9–8. 4	4–40	Low------	High------	High.
-------	100	80–90	70–80	50–60	30–40	0. 06–0. 2	0. 14–0. 16	7. 9–8. 4	1–4	High------	High------	Moderate.
95–100	85–95	50–60	25–35	-------	NP	2. 0–6. 0	0. 10–0. 12	7. 9–8. 4	1–2	Low------	Moderate--	Moderate.
70–90	50–70	30–40	0–10	-------	NP	6. 0–20. 0	0. 05–0. 07	7. 9–8. 4	1–2	Low------	Moderate--	Low.
80–95	75–85	40–50	20–30	-------	NP	2. 0–6. 0	0. 07–0. 09	7. 9–8. 4	1–2	Low------	Low------	Low.
40–60	30–50	5–40	5–10	-------	NP	>20. 0	0. 03–0. 05	7. 9–8. 4	1–2	Low------	Low------	Low.
100	95–100	80–90	65–75	30–40	15–25	0. 06–0. 2	0. 14–0. 16	8. 5–9. 6	4–8	Moderate-	High------	High.
100	95–100	65–75	50–60	30–40	5–10	0. 2–0. 6	0. 11–0. 13	8. 5–9. 6	4–15	Low------	High------	High.
-------	100	90–100	80–95	36–55	15–30	0. 06–0. 2	0. 14–0. 16	7. 9–8. 9	4–15	High------	High------	Moderate.
-------	100	85–95	60–75	25–35	NP–5	0. 6–2. 0	0. 16–0. 18	7. 9–8. 9	4–15	Low------	High------	Low.
40–65	30–50	20–40	15–30	20–30	NP–5	0. 6–2. 0	0. 10–0. 12	7. 9–8. 4	1–4	Low------	High------	Low.
95–100	85–95	60–70	25–35	25–30	2–4	2. 0–6. 0	0. 11–0. 13	7. 9–8. 4	1–2	Low------	High------	Low.
95–100	80–90	60–70	30–45	25–30	8–10	2. 0–6. 0	0. 10–0. 12	7. 9–8. 4	2–4	Low------	High------	Low.
30–75	25–70	20–65	15–60	41–60	20–40	0. 06–0. 2	0. 08–0. 10	7. 9–8. 4	1–2	Moderate-	High------	Low.
30–75	25–70	25–50	15–35	30–40	11–20	0. 2–0. 6	0. 05–0. 08	7. 9–8. 4	1–2	Low------	High------	Low.

TABLE 5.—*Estimates of soil propertie*

Soil series and map symbols	Hydrologic group	Depth from surface	Dominant USDA texture	Classification		Coarse fraction greater than 3 inches in diameter
				Unified	AASHTO	
		Inches				
Estrella:						
Es	B	0–24	Loam	ML	A–4	0
		24–60	Clay loam	CL	A–6	0
Et	B	0–24	Loam	ML	A–4	0
		24–60	Clay loam	CL	A–6	0
*Gachado: GA	D	0–14	Very gravelly sandy clay loam.	GC	A–6 or A–2	5–15
No valid estimate can be made for Rock outcrop part.		14	Bedrock.			
Gadsden: [1]						
Gb, Gc	D	0–60	Clay and clay loam	CH	A–7	0
Gd	D	0–60	Clay and clay loam	CH	A–7	0
*Gilman: [1]						
Ge, GgA, GgB, GM, GN	B	0–60	Loam and very fine sandy loam.	ML	A–4	0
For Antho part of GM and Laveen part of GN, see their respective series.						
Gf, Gh, GL, Go3	B	0–60	Loam and very fine sandy loam.	ML	A–4	0
For Antho and Glenbar parts of Go3, see their respective series.						
Gilman variant: [1] Gp	C	0–28	Very fine sandy loam	ML	A–4	0
		28–60	Silty clay	CH	A–7	0
Glenbar:						
Gr, Gt, Gv	B	0–60	Clay loam and silty clay loam.	CL	A–6 or A–7	0
Gs, Gu	B	0–60	Clay loam and silty clay loam.	CL	A–6 or A–7	0
*Gunsight: GWD, GxA, GxB, GYD	B	0–60	Gravelly loam and very gravelly loam.	GC	A–2 and A–1	0–15
For Pinal part of GWD and Rillito part of GxA, GxB, and GYD, see their respective series.						
*Harqua: HAB, HAC, HLC, HM, HrB	C	0–14	Gravelly clay loam and loam.	CL	A–6	0
For Gunsight part of HLC, Laveen part of HM, and Rillito part of HrB, see their respective series.		14–60	Gravelly clay loam	SC	A–6	0–5
La Palma: La	C	0–7	Very fine sandy loam	ML	A–4	0
		7–27	Clay loam or heavy loam.	CL	A–6	0
		27	Indurated hardpan.			
*Laveen:						
Lb, LcA, LcB, Le	B	0–60	Loam	ML	A–4 or A–6	0
Ld, Lf	B	0–60	Loam	ML	A–4 or A–6	0
For Antho part of Lf, see Ac in Antho series.						
Maripo: Ma	B	0–34	Sandy loam	SM	A–2 or A–4	0
		34–60	Gravelly sand	SM or SP	A–1	0
*Mohall: Mo, Mp, Mr, Ms, MTB, MV	B	0–35	Clay loam	CL	A–6	0
For Laveen part of MV and Tremant part of MTB, see their respective series.		35–60	Very fine sandy loam	ML	A–4	0
*Perryville:						
Pa, PeA, PeB, PRB	B	0–38	Gravelly loam	SM or SC–SM	A–2 or A–4	0
For Rillito part of PRB, see Rillito series.		38–60	Sandy loam	SM	A–2	0–10
Pb	B	0–38	Gravelly loam	SM or SC–SM	A–2 or A–4	0
		38–60	Sandy loam	SM	A–2	0–10

See footnotes at end of table.

significant in engineering—Continued

Percentage of material less than 3 inches in diameter passing sieve—				Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential	Risk of corrosion to—	
No. 4	No. 10	No. 40	No. 200								Uncoated steel	Concrete
						Inches per hour	*Inches per inch of soil*	*pH*	*Millimhos per centimeter*			
100	95–100	75–85	65–75	-------	NP	0. 6–2. 0	0. 16–0. 18	7. 9–8. 4	1–2	Low------	High------	Low.
-------	100	85–95	70–80	30–40	12–18	0. 2–0. 6	0. 18–0. 20	7. 9–8. 5	2–4	Moderate--	High------	Low.
100	95–100	75–85	65–75	-------	NP	0. 6–2. 0	0. 16–0. 18	7. 9–8. 4	1–2	Low------	High------	Low.
-------	100	85–95	70–80	30–40	12–18	0. 2–0. 6	0. 18–0. 20	8. 5–9. 6	4–8	Moderate--	High------	Low.
60–70	50–70	40–50	25–40	30–40	15–20	0. 06–0. 20	0. 08–0. 16	7. 9–8. 4	1–2	Low------	High------	Low.
-------	100	90–100	80–90	50–60	25–35	0. 2–0. 06	0. 15–0. 17	7. 9–8. 4	2–4	High------	High------	Moderate.
-------	100	90–100	80–90	50–60	25–35	0. 2–0. 06	0. 15–0. 17	8. 5–9. 0	4–15	High------	High------	High.
100	95–100	75–85	65–75	-------	NP	0. 6–2. 0	0. 16–0. 18	7. 9–8. 4	1–2	Low------	High------	Low.
100	95–100	75–85	65–75	-------	NP	0. 6–2. 0	0. 16–0. 18	8. 4–9. 6	4–40	Low------	High------	Moderate to high.
100	95–100	75–85	65–75	-------	NP	0. 6–2. 0	0. 16–0. 18	7. 9–8. 4	9–15	Low------	High------	High.
100	100	90–100	80–90	50–60	25–35	0. 2–0. 6	0. 14–0. 16	7. 9–8. 4	9–15	High------	High------	High.
100	95–100	85–95	75–85	35–45	20–30	0. 2–0. 6	0. 19–0. 21	7. 9–8. 4	0–4	Moderate to high.	High------	Low to moderate.
100	95–100	85–95	75–85	35–45	20–30	0. 2–0. 6	0. 19–0. 21	7. 9–9. 0	4–15	Moderate to high.	High----	High.
35–60	25–50	20–30	15–20	20–30	10–15	0. 6–2. 0	0. 05–0. 07	7. 9–8. 4	1–4	Low------	High------	Low.
85–100	65–85	60–75	50–65	30–40	12–20	0. 2–0. 6	0. 17–0. 19	7. 9–9. 0	4–20	Moderate--	High------	High.
80–90	65–85	55–75	40–60	30–40	11–20	0. 2–0. 6	0. 09–0. 11	7. 9–9. 6	15–60	Moderate--	High------	High.
100	100	85–95	60–75	25–35	NP	0. 6–2. 0	0. 16–0. 18	7. 9–9. 0	4–15	Low------	High------	High.
100	100	90–100	70–80	30–40	15–25	0. 06–0. 2	0. 10–0. 18	8. 5–9. 6	8–20	Moderate--	High------	High.
95–100	85–100	70–85	50–70	25–40	NP–15	0. 6–2. 0	0. 13–0. 18	7. 9–8. 4	1–4	Low------	High------	Low to moderate.
95–100	85–100	70–85	50–70	25–40	NP–15	0. 6–2. 0	0. 13–0. 18	8. 5–9. 6	4–8	Low------	High------	High.
95–100	85–95	60–70	30–40	-------	NP	2. 0–6. 0	0. 11–0. 13	7. 9–8. 4	1–2	Low------	High------	Low.
75–90	60–75	30–45	0–15	-------	NP	6. 0–20. 0	0. 04–0. 06	7. 9–8. 4	1–2	Low------	High------	Low.
95–100	95–100	85–95	70–80	30–40	20–30	0. 2–0. 6	0. 19–0. 21	7. 9–8. 4	1–2	Moderate--	High------	Low.
95–100	95–100	85–95	50–65	25–35	NP	0. 6–2. 0	0. 15–0. 17	7. 9–8. 4	1–2	Low------	High------	Low.
80–90	55–75	40–55	30–40	25–40	5–10	0. 6–2. 0	0. 10–0. 13	7. 9–8. 4	1–2	Low------	High------	Low.
95–100	85–95	55–65	25–35	20–30	NP–5	2. 0–6. 0	0. 09–0. 11	7. 9–8. 4	1–4	Low------	High------	Low.
80–90	55–75	40–55	30–40	25–40	5–10	0. 6–2. 0	0. 10–0. 13	8. 5–9. 6	4–8	Low------	High------	High.
95–100	85–95	55–65	25–35	20–30	NP–5	2. 0–6. 0	0. 09–0. 11	8. 5–9. 6	4–8	Low------	High------	High.

TABLE 5.—*Estimates of soil properties*

Soil series and map symbols	Hydrologic group	Depth from surface	Dominant USDA texture	Classification		Coarse fraction greater than 3 inches in diameter
				Unified	AASHTO	
		Inches				
*Pinal: PsA, PsB, PT, PvB, PWB For La Palma part of PvB and Suncity part of PWB, see their respective series.	D	0–12 12	Loam Indurated silica-cemented hardpan.	ML or SM	A–4	0–5
*Pinamt: PYD For Tremant part, see Tremant series.	B	0–22 22–60	Very gravelly sandy clay loam. Very gravelly sandy loam.	GM GM	A–2 A–1	5–40 5–30
*Rillito: RaA, RaB, RbA, RbB, RhB, RpE For Harqua part of RhB and Perryville part of RpE, see their respective series.	B	0–60	Gravelly loam and gravelly sandy loam.	SM or SC–SM	A–2 or A–4	0
*Rock outcrop: RS. For Cherioni part, see Cherioni series. No valid estimate can be made for Rock outcrop.						
Suncity Mapped only in a complex with Pinal soils.	D	0–13 13	Clay loam Indurated silica-lime cemented hardpan.	CL	A–6	0–5
Toltec: Ta	C	0–28 28–60	Loam Weakly to strongly cemented hardpan.	ML	A–4	0
Torrifluvents: [1] TB. No valid estimate can be made.						
Torriorthents: Tc. No valid estimate can be made.						
*Torripsamments: TD. No valid estimate can be made. For Torrifluvents part, see Torrifluvents.						
*Tremant: Te, TfA, TfB, Tg, Th, TPB, TrA, TrB, TSC. For Rillito part of TrA, TrB, and TSC, see Rillito series.	B	0–23 23–60	Gravelly clay loam Gravelly loam	SC or GC SM	A–6 A–4	0–10 0–10
Trix: Tt	B	0–60	Clay loam	CL	A–6	0
Tucson: Tu, Tw	B	0–14 14–60	Loam Clay loam and loam	ML CL	A–4 A–6	0 0
Valencia: Va, Vc	B	0–26 26–60	Sandy loam Clay loam and sandy clay loam.	SM CL	A–2 A–6	0 0
Vb	B	0–26 26–60	Sandy loam Clay loam and sandy clay loam.	SM CL	A–2 A–6	0 0
Vecont: Ve, Vf	D	0–60	Clay	CH	A–7	0
*Vint: [1] Vg, Vh, Vk, Vn, Vr For Carrizo part of Vr, see Carrizo series.	B	0–60	Loamy fine sand	SM	A–2	0
Wintersburg: Wg	C	0–60	Clay loam and loam	CL	A–6	0

[1] Subject to rare flooding of very brief duration in local areas.
[2] NP is nonplastic.

significant in engineering—Continued

Percentage of material less than 3 inches in diameter passing sieve—				Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential	Risk of corrosion to—	
No. 4	No. 10	No. 40	No. 200								Uncoated steel	Concrete
						Inches per hour	*Inches per inch of soil*	*pH*	*Millimhos per centimeter*			
80–95	70–85	65–75	40–60	25–35	NP–10	0. 6–2. 0	0. 12–0. 18	7. 9–8. 4	2–4	Low	High	Low.
45–75	30–55	20–40	15–30	30–40	5–10	0. 2–0. 6	0. 08–0. 10	7. 9–8. 4	1–4	Low	High	Low.
45–75	30–55	15–30	15–20	-------	NP	2. 0–6. 0	0. 05–0. 07	7. 9–8. 4	1–4	Low	High	Low.
80–90	50–75	40–60	30–40	25–35	NP–15	0. 6–2. 0	1. 09–0. 12	7. 9–8. 4	0–4	Low	High	Moderate.
90–100	85–95	70–85	60–70	30–40	10–20	0. 2–0. 6 <0. 06	0. 15–0. 18	7. 9–8. 4	4–20	Moderate	High	Moderate to high.
100	100	75–90	60–75	30–40	NP–10	0. 6–2. 0	0. 16–0. 18	7. 9–8. 4	2–4	Low	High	Moderate.
-------	-------	-------	-------	-------	-------	0. 06–0. 2	0. 06–0. 08	7. 9–9. 0	2–15	Low	High	Moderate.
60–80	50–75	45–60	35–50	20–40	10–20	0. 2–0. 6	0. 13–0. 15	7. 9–8. 4	1–4	Moderate	High	Low.
55–75	50–70	45–60	35–45	25–35	NP–10	0. 6–2. 0	0. 08–0. 11	7. 9–8. 4	1–4	Low	High	Low.
-------	100	90–100	70–85	30–40	20–30	0. 2–0. 6	0. 19–0. 21	7. 9–8. 4	1–2	Moderate	High	Low.
-------	100	85–95	60–75	25–35	NP–5	0. 6–2. 0	0. 16–0. 18	7. 9–8. 4	1–4	Low	High	Moderate.
-------	100	90–100	70–85	30–40	15–20	0. 2–0. 6	0. 19–0. 21	7. 9–8. 4	1–4	Moderate	High	Moderate.
95–100	75–95	65–75	25–35	-------	NP	2. 0–6. 0	0. 11–0. 13	7. 9–8. 4	1–4	Low	High	Moderate.
100	95–100	90–100	70–80	30–40	15–20	0. 2–0. 6	0. 15–0. 21	7. 9–8. 4	1–4	Moderate	High	Moderate.
95–100	75–95	65–75	25–35	-------	NP	2. 0–6. 0	0. 11–0. 13	7. 9–8. 4	1–4	Low	High	Moderate.
100	95–100	90–100	70–80	30–40	15–20	0. 2–0. 6	0. 15–0. 21	8. 5–9. 6	4–8	Moderate	High	Moderate.
100	95–100	85–95	75–90	50–60	30–40	0. 06–0. 2	0. 10–4. 16	7. 9–8. 4	1–4	High	High	Low.
100	90–100	70–90	15–25	-------	NP	2. 0–6. 0	0. 09–0. 11	7. 9–8. 4	1–4	Low	High	Low.
100	100	85–100	70–80	25–40	15–20	0. 2–0. 6	0. 17–0. 20	7. 9–8. 4	2–4	Moderate	High	Moderate.

[3] High salt content.

TABLE 6.—*Interpretation of*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil that may have appear in the

Soil series and map symbols	Degree and kind of limitation for—			
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings without basements
Agualt: Aa	Slight: possible hazard of pollution of ground water.	Severe: very rapidly permeable below a depth of 20 to 40 inches.	Severe: too sandy; unstable below a depth of 20 to 40 inches.	Slight: some areas subject to occasional flooding.
*Antho: AbA, AbB, Ac, AdA, AdB, Ae, AfA, AfB, AGB, AHC, AkB, AL, AM. For Brios part of Ae; Carrizo part of AfA, AfB, AGB; Tremant part of AHC; Mohall part of AkB; and Valencia part of AM, see their respective series.	Slight	Severe: moderately rapidly permeable.	Slight: gravelly phases are moderate.	Slight
Avonda: An	Slight: possible hazard of pollution of ground water.	Severe: rapidly permeable below a depth of 20 to 40 inches.	Severe: too sandy; unstable below a depth of 20 to 40 inches.	Slight
Avondale: Ao, Ap	Slight	Moderately permeable.	Slight	Slight
Beardsley: BE	Severe: slowly permeable over impermeable pan.	Severe: impermeable pan at a depth of 20 to 40 inches.	Severe: hardpan below a depth of 20 to 40 inches.	Severe: high shrink-swell potential; less than 20 to 40 inches to indurated hardpan.
Brios: Br, Bs, Bt	Severe: flooding; possible hazard of pollution to ground water.	Severe: rapidly permeable.	Severe: too sandy; unstable.	Severe: flooding
*Calciorthids: CA2. For Torriorthents part, see Torriorthents. Too variable to be estimated.				
*Carrizo: Cb, CeD, CF. For Ebon part of CeD and Brios part of CF, see their respective series.	Severe: flooding; possible hazard of pollution to ground water.	Severe: rapidly permeable.	Severe: too sandy; unstable.	Severe: flooding
*Casa Grande: Cg, Ch, Ck, Cm. For Laveen part of Cm, see Laveen series.	Severe: slowly permeable.	Slight	Moderate: unstable; high salt content.	Moderate: moderate shrink-swell potential.
Cashion: Cn	Slight	Slight	Moderate: too clayey.	Severe: high shrink-swell potential; flooding in some areas.

engineering properties

different properties and limitations. For this reason it is necessary to follow carefully the instructions for referring to other series that first column]

Degree and kind of limitation for—Continued		Suitability as a source of—			Soil features affecting—	
Sanitary landfill (trench type)	Local roads and streets	Road fill	Sand	Topsoil	Pond reservoir areas	Embankments, dikes, and levees
Severe: too sandy; very rapidly permeable below a depth of 20 to 40 inches.	Moderate: excess fines.	Good	Fair: 20 to 40 inches of overburden.	Poor: sand below a depth of 20 to 40 inches.	Rapidly permeable.	Medium shear strength; high compacted permeability.
Severe: too sandy; rapidly permeable.	Slight	Good	Poor: high content of fines.	Good	Moderately rapidly permeable.	Fair to good compaction characteristics; medium to low compacted permeability; susceptible to piping; medium shear strength.
Severe: rapidly permeable below a depth of 20 to 40 inches.	Moderate: excess fines.	Fair: excess fines.	Fair: 20 to 40 inches of overburden.	Poor: loamy coarse sand below a depth of 20 to 40 inches.	Rapidly permeable below a depth of 20 to 40 inches.	Susceptible to piping; high compacted permeability; medium to low shear strength.
Slight	Moderate: moderate shrink-swell potential.	Fair: excess fines.	Unsuited: excess fines.	Fair: clay loam. Poor for Ap: excess salts.	Moderately and moderately slowly permeable.	Susceptible to piping; medium compacted permeability; medium to low shear strength.
Severe: hardpan at a depth of 20 to 40 inches.	Severe: high shrink-swell potential; hardpan at a depth of 20 to 40 inches.	Poor: high shrink-swell potential; hardpan at a depth of 20 to 40 inches.	Unsuited: excess fines.	Poor: clay; hardpan at a depth of 20 to 40 inches.	Hardpan at a depth of 20 to 40 inches.	Low shear strength; low compacted permeability.
Severe: too sandy; rapidly permeable.	Severe: flooding.	Good	Good	Poor: less than 20 inches to sand.	Rapidly permeable.	Medium to low compacted permeability; medium shear strength; susceptible to piping.
Severe: rapidly permeable.	Severe: flooding.	Good if soil binder is used.	Good	Poor: less than 20 inches to gravelly sand.	Very rapidly permeable.	High shear strength; high compacted permeability.
Moderate: too clayey.	Severe: excess fines.	Poor: excess fines; moderate shrink-swell potential.	Unsuited: excess fines.	Poor: excess salts.	Slowly permeable.	Low shear strength; low compacted permeability; susceptible to piping.
Slight	Severe: high shrink-swell potential; flooding in some areas.	Poor: high shrink-swell potential.	Unsuited: excess fines.	Poor: clayey; excess salts.	Slowly permeable.	Low compacted permeability; medium shear strength; susceptible to piping.

TABLE 6.—*Interpretation of*

Soil series and map symbols	Degree and kind of limitation for—			
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings without basements
*Cherioni: CO Rock outcrop part is too variable to be rated.	Severe: less than 20 inches to bedrock.	Severe: less than 20 inches to bedrock.	Severe: less than 20 inches to bedrock.	Severe: less than 20 inches to bedrock.
*Coolidge: Cp, CrB, Cs, CV For Tremant part of Cs and Laveen part of CV, see their respective series.	Slight	Severe: moderately rapidly permeable.	Slight to moderate: gravelly.	Slight
Dune land: Dn. Too variable to be rated.				
*Ebon: EbD, EPD For Pinamt part of EPD, see Pinamt series.	Severe: slowly permeable.	Severe: 50 to 90 percent gravel and cobbles.	Severe: 50 to 90 percent gravel and cobbles.	Slight
Estrella: Es, Et	Severe: moderately slowly permeable.	Slight	Slight	Moderate: moderate shrink-swell potential.
*Gachado: GA Rock outcrop part is too variable to be rated.	Severe: bedrock at a depth of less than 20 inches.	Severe: bedrock at a depth of less than 20 inches.	Severe: bedrock at a depth of less than 20 inches.	Severe: bedrock at a depth of less than 20 inches.
Gadsden: Gb, Gc, Gd	Severe: slowly permeable.	Slight	Severe: too clayey	Severe: high shrink-swell potential.
*Gilman: Ge, Gf, GgA, GgB, Gh, GL, GM, GN, Go3. For Antho part of GM, Laveen part of GN, and Antho and Glenbar part of Go3, see their respective series.	Slight	Moderate: moderately permeable.	Slight	Slight: flooding in some areas.
Gilman variant: Gp	Severe: slowly permeable.	Slight: flooding in some areas.	Severe: too clayey below a depth of 20 to 40 inches.	Severe: high shrink-swell potential below a depth of 20 to 40 inches; flooding in some areas.
Glenbar: Gr, Gs, Gt, Gu, Gv	Severe: moderately slowly permeable.	Slight	Moderate: too clayey.	Moderate: moderate to high shrink-swell potential.
*Gunsight: GWD, GxA, GxB, GYD For Pinal part of GWD and Rillito part of GxA, GxB, and GYD, see their respective series.	Slight if slopes are 0 to 8 percent. Moderate if slopes are more than 8 percent.	Severe: more than 50 percent gravel and cobbles; slopes are more than 7 percent in some places.	Severe: more than 50 percent gravel and cobbles.	Slight if slopes are 0 to 8 percent. Moderate if slopes are more than 8 percent.

engineering properties—Continued

Degree and kind of limitation for—Continued		Suitability as a source of—			Soil features affecting—	
Sanitary landfill (trench type)	Local roads and streets	Road fill	Sand	Topsoil	Pond reservoir areas	Embankments, dikes, and levees
Severe: less than 20 inches to bedrock.	Severe: less than 20 inches to bedrock.	Poor: bedrock at a depth of less than 20 inches.	Poor: excess fines.	Poor: very gravelly and cobbly; less than 20 inches to bedrock; slope.	Less than 20 inches to bedrock; slopes are 3 to 25 percent.	Less than 20 inches to bedrock.
Slight	Slight	Good	Poor: excess fines.	Fair: 24 inches to lime accumulation.	Moderately rapidly permeable.	Medium compacted permeability; medium shear strength; susceptible to piping.
Slight	Slight	Good	Unsuited: excess fines.	Poor: more than 50 percent gravel and cobbles.	50 to 90 percent gravel and cobbles.	Low compacted permeability; medium shear strength.
Slight	Moderate: excess fines.	Fair: excess fines.	Unsuited: excess fines.	Good	Moderately slowly permeable.	Medium compacted permeability; susceptible to piping; low shear strength.
Severe: bedrock at a depth of less than 20 inches.	Severe: bedrock at a depth of less than 20 inches.	Poor: limited material.	Unsuited: excess fines; limited material.	Poor: less than 20 inches to bedrock.	15 to 50 percent gravel and cobbles; less than 20 inches to bedrock.	Less than 20 inches to bedrock.
Severe: too clayey.	Severe: high shrink-swell potential; excess fines.	Poor: high shrink-swell potential; excess fines.	Unsuited: excess fines.	Poor: clayey; Gd is high in salts.	Slowly permeable	Low shear strength; low compacted permeability.
Slight: flooding in some areas.	Moderate: excess fines; flooding in some areas.	Fair: excess fines.	Unsuited: excess fines.	Good. Fair to poor for Gf, Gh, and part of GL; contains toxic quantities of salts.	Moderately permeable.	Medium compacted permeability; susceptible to piping; low shear strength.
Severe: too clayey below a depth of 20 to 40 inches; flooding in some areas.	Severe: excess fines below a depth of 20 to 40 inches; high shrink-swell potential; flooding in some areas.	Poor: excess fines.	Unsuited: excess fines.	Poor: excess salts.	Slowly permeable	Low shear strength; low compacted permeability; susceptible to piping.
Moderate: too clayey.	Severe: moderate to high shrink-swell potential; excess fines.	Poor: excess fines; moderate to high shrink-swell potential.	Unsuited: excess fines.	Fair: clay loam. Poor for Gs: excess salts.	Moderately slowly permeable.	Susceptible to piping; medium compacted permeability; low shear strength.
Slight: underlain by coarse sand and gravel below a depth of 5 feet in some areas.	Slight if slopes are 0 to 8 percent. Moderate if slopes are more than 8 percent.	Good	Unsuited: excess fines.	Poor: more than 50 percent gravel and cobbles.	Moderately slowly permeable; more than 50 percent coarse fragments.	Low compacted permeability; medium shear strength.

TABLE 6.—*Interpretation of*

Soil series and map symbols	Degree and kind of limitation for—			
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings without basements
*Harqua: HAB, HAC, HLC, HM, HrB—For Gunsight part of HLC, Laveen part of HM, and Rillito part of HrB, see their respective series.	Severe: moderately slowly permeable.	Moderate: 15 to 50 percent gravel.	Moderate: gravelly.	Moderate: moderate shrink-swell potential.
La Palma: La	Severe: indurated hardpan at a depth of 20 to 40 inches.	Severe: less than 40 inches to hardpan.	Severe: rippable indurated hardpan at a depth of 20 to 40 inches.	Moderate: moderate shrink-swell potential.
*Laveen: Lb, LcA, LcB, Ld, Le, Lf—For Antho part of Lf, see Antho series.	Slight	Moderate: moderately permeable.	Slight	Slight
Maripo: Ma	Slight: possible pollution to ground water.	Severe: moderately rapidly permeable below a depth of 20 to 40 inches.	Severe: unstable below a depth of 20 to 40 inches.	Slight
*Mohall: Mo, Mp, Mr, Ms, MTB, MV—For Tremant part of MTB, and Laveen part of MV, see their respective series.	Severe: moderately slowly permeable.	Moderate: moderately permeable below a depth of 20 to 40 inches.	Moderate: too clayey.	Moderate: moderate shrink-swell potential.
*Perryville: Pa, Pb, PeA, PeB, PRB—For Rillito part of PRB, see Rillito series.	Slight	Moderate: moderately permeable.	Moderate: gravelly.	Slight
*Pinal: PsA, PsB, PT, PvB, PWB—For La Palma part of PvB and Suncity part of PWB, see their respective series.	Severe: less than 20 inches to hardpan.	Severe: less than 20 inches to hardpan.	Severe: less than 20 inches to hardpan.	Severe: less than 20 inches to hardpan.
*Pinamt: PYD—For Tremant part of PYD, see Tremant series.	Slight	Severe: more than 50 percent coarse fragments; moderately rapidly permeable below a depth of 22 inches.	Severe: very gravelly.	Slight
*Rillito: RaA, RaB, RbA, RbB, RhB, RpE. For Harqua part of RhB and Perryville part of RpE, see their respective series.	Slight	Moderate: moderately permeable.	Moderate: gravelly.	Slight
*Rock outcrop: RS. Too variable to be rated. For Cherioni part, see Cherioni series.				

engineering properties—Continued

Degree and kind of limitation for—Continued		Suitability as a source of—			Soil features affecting—	
Sanitary landfill (trench type)	Local roads and streets	Road fill	Sand	Topsoil	Pond reservoir areas	Embankments, dikes, and levees
Slight	Moderate: moderate shrink-swell potential; excess fines.	Fair: excess fines; moderate shrink-swell potential.	Unsuited: excess fines.	Poor: excess salts; more than 15 percent gravel.	Moderately slowly permeable; 15 to 50 percent gravel.	Medium shear strength; low compacted permeability.
Severe: rippable hardpan at a depth of 20 to 40 inches.	Severe: excess fines; moderate shrink-swell potential.	Poor: excess fines; moderate shrink-swell potential.	Unsuited: excess fines.	Poor: excess salts.	Hardpan at a depth of 20 to 40 inches.	Low shear strength; low compacted permeability; susceptible to piping.
Slight	Moderate: excess fines.	Fair: excess fines.	Unsuited: excess fines.	Fair below a depth of 14 to 24 inches; high lime content. Poor for Ld and Lf: excess salts.	Moderately permeable.	Low shear strength; susceptible to piping.
Severe: too sandy; moderately rapidly permeable below a depth of 20 to 40 inches.	Slight	Good	Fair: excess fines.	Poor: gravelly loamy sand at a depth of 20 to 40 inches.	Moderately rapidly permeable.	Medium shear strength; medium compacted permeability; susceptible to piping.
Moderate: too clayey.	Severe: excess fines; moderate shrink-swell potential.	Fair: excess fines; moderate shrink-swell potential.	Unsuited: excess fines.	Fair: clay loam	Moderately slowly permeable.	Low shear strength; medium compacted permeability; susceptible to piping.
Slight	Moderate: excess fines.	Fair: excess fines.	Unsuited: excess fines.	Poor: more than 15 percent gravel.	Moderately permeable; 15 to 50 percent gravel.	Medium compacted permeability; medium shear strength.
Severe: less than 20 inches to hardpan.	Severe: less than 20 inches to hardpan.	Poor: less than 20 inches to hardpan.	Unsuited: excess fines.	Poor: less than 20 inches to hardpan.	Less than 20 inches to hardpan.	Less than 20 inches to hardpan.
Severe: moderately rapidly permeable below a depth of 20 to 40 inches.	Slight	Good	Unsuited: excess fines and coarse fragments.	Poor: very cobbly.	More than 50 percent coarse fragments; moderately slowly permeable.	Medium shear strength; medium compacted permeability.
Slight	Slight	Good	Poor to unsuited: excess fines.	Poor: more than 15 percent coarse fragments.	Moderately permeable.	Medium compacted permeability; medium shear strength.

TABLE 6.—*Interpretation of*

Soil series and map symbols	Degree and kind of limitation for—			
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings without basements
Suncity Mapped only in complex with Pinal soils.	Severe: less than 20 inches to hardpan.	Severe: less than 20 inches to hardpan.	Severe: less than 20 inches to hardpan.	Severe: less than 20 inches to hardpan.
Toltec: Ta	Severe: hardpan at a depth of 20 to 40 inches.	Severe: hardpan at a depth of 20 to 40 inches.	Severe: hardpan at a depth of 20 to 40 inches.	Slight
Torrifluvents: TB. Too variable to be rated.				
Torriorthents: Tc. Too variable to be rated.				
*Torripsamments: TD. Too variable to be rated. For Torrifluvents part, see Torrifluvents.				
*Tremant: Te, TfA, TfB, Tg, Th, TPB, TrA, TrB, TSC. For Rillito part of TrA, TrB, and TSC, see Rillito series.	Slight if lines are below slowly permeable solum.	Moderate: 15 to 35 percent coarse fragments; moderately permeable below a depth of 20 inches.	Moderate: gravelly	Slight
Trix: Tt	Severe: moderately slowly permeable.	Slight	Moderate: too clayey.	Moderate: moderate shrink-swell potential.
Tucson: Tu, Tw	Severe: moderately slowly permeable.	Slight	Moderate: too clayey.	Moderate: moderate shrink-swell potential.
Valencia: Va, Vb, Vc	Severe: moderately slowly permeable.	Slight	Moderate: too clayey.	Slight
Vecont: Ve, Vf	Severe: slowly permeable.	Slight	Severe: too clayey.	Severe: high shrink-swell potential.
*Vint: Vg, Vh, Vk, Vn, Vr For Carrizo part of Vr, see Carrizo series.	Slight: possible hazard of pollution to ground water.	Severe: moderately rapidly permeable.	Severe: too sandy	Slight
Wintersburg: Wg	Severe: moderately slowly permeable.	Slight	Slight	Moderate: moderate shrink-swell potential.

engineering properties—Continued

Degree and kind of limitation for—Continued		Suitability as a source of—			Soil features affecting—	
Sanitary landfill (trench type)	Local roads and streets	Road fill	Sand	Topsoil	Pond reservoir areas	Embankments, dikes, and levees
Severe: less than 20 inches to hardpan.	Severe: less than 20 inches to hardpan.	Poor: excess fines; less than 20 inches to hardpan.	Unsuited: less than 20 inches to hardpan; excess fines.	Poor: less than 20 inches to hardpan; excess salts.	Less than 20 inches to hardpan.	Less than 20 inches to hardpan.
Slight	Moderate: excess fines.	Fair: excess fines.	Unsuited: excess fines.	Poor: hardpan at a depth of 20 to 40 inches.	Slowly permeable.	Medium compacted permeability; low shear strength; susceptible to piping.
Slight	Moderate: moderate shrink-swell potential.	Fair: excess fines.	Unsuited: excess fines.	Poor: more than 15 percent gravel.	Slowly permeable.	Medium compacted permeability; medium shear strength.
Slight	Moderate: excess fines; moderate shrink-swell potential.	Poor: excess fines.	Unsuited: excess fines.	Fair: clay loam.	Moderately slowly permeable.	Medium shear strength; fair to good compaction characteristics; medium compacted permeability.
Slight	Severe: excess fines; moderate shrink-swell potential.	Poor: excess fines.	Unsuited: excess fines.	Fair: clay loam.	Moderately slowly permeable.	Fair to good compaction characteristics; medium shear strength; medium compacted permeability.
Moderate: too clayey.	Slight	Fair: excess fines.	Poor: excess fines.	Good. Poor for Vb: excess fines.	Moderately slowly permeable.	Medium shear strength; good compaction characteristics; low compacted permeability.
Severe: too clayey.	Severe: high shrink-swell potential; excess fines.	Poor: excess fines.	Unsuited: excess fines.	Poor: clay	Slowly permeable.	Low shear strength; fair compaction characteristics; low compacted permeability.
Severe: too sandy; moderately rapidly permeable; flooding in some areas.	Slight: flooding in some areas.	Good	Fair: 15 to 25 percent fines.	Poor: loamy sand.	Moderately rapidly permeable.	Fair compaction characteristics; susceptible to piping; medium shear strength.
Slight	Severe: excess fines; moderate shrink-swell potential.	Poor: excess fines.	Unsuited: excess fines.	Fair: clay loam.	Moderately slowly permeable.	Low shear strength; fair compaction characteristics; low compacted permeability.

In the Unified system (*7*) soils are classified according to particle size distribution, plasticity, liquid limit, and content of organic matter. Soils are grouped in 15 classes. There are eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes are designated by symbols for both classes; for example, CL–ML.

The AASHTO system (*1*) is used to classify soils according to those properties that affect use in highway construction and maintenance. In this system, a soil is placed in one of seven basic groups ranging from A–1 through A–7 on the basis of grain-size distribution, liquid limit, and plasticity index. In group A–1 are gravelly soils of high bearing strength, or the best soils for subgrade (foundation). At the other extreme, in group A–7, are clay soils that have low strength when wet and that are the poorest soils for subgrade. Where laboratory data are available to justify a further breakdown, the A–1, A–2, and A–7 groups are divided as follows: A–1–a, A–1–b, A–2–4, A–2–5, A–2–6, A–2–7, A–7–5, and A–7–6. As additional refinement, the engineering value of a soil material can be indicated by a group index number. Group indexes range from 0 for the best material to 20 or more for the poorest. The estimated AASHTO classification, without group index numbers, is given in table 5 for all soils mapped in the survey area.

Soil properties significant in engineering

Several estimated soil properties significant in engineering are listed in table 5. These estimates are for representative soil profiles, by layers sufficiently different to have different significance in soil engineering. The estimates are based on field observations made in the course of mapping, on test data for these and similar soils, and on experience with the same kinds of soil in other counties. Following are explanations of some of the columns in table 5.

Soil texture is described in table 5 in the standard terms used by the Department of Agriculture. These terms take into account relative percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that contains 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the soil contains gravel or other particles coarser than sand, an appropriate modifier is added, for example, "gravelly loamy sand." "Sand," "silt," "clay," and some of the other terms used in USDA textural classification are defined in the Glossary at the back of this soil survey.

Depth to water table is not given in table 5 because none of the soils in the survey area have a high water table. The water table remains at such a great depth that it is not significant in engineering projects.

Depth to bedrock is not given in table 5 because most soils in the survey area are deep enough over bedrock that bedrock does not affect their use. Bedrock is at a depth of 6 to 20 inches in the Cherioni soils and at a depth of 9 to 20 inches in the Gachado soils.

Liquid limit and plasticity index indicate the effect of water on the strength and consistence of soil material. As the moisture content of a clayey soil is increased from a dry state, the material changes from a semisolid to a plastic state. If the moisture content is further increased, the material changes from a plastic to a liquid state. The plastic limit is the moisture content at which the soil material changes from the semisolid to plastic state; and the liquid limit, from a plastic to a liquid state. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is plastic. Liquid limit and plasticity index are estimated in table 5.

Permeability is the quality that enables a soil to transmit water or air. It is estimated on basis of those soil characteristics observed in the field, particularly structure, porosity, and texture. The estimates in table 5 do not take into account lateral seepage or such transient soil features as plowpans and surface crusts.

Available water capacity is the ability of soils to hold water for use by most plants. It is commonly defined as the difference between the amount of water in the soil at field capacity and the amount at the wilting point of most crop plants.

Reaction is the degree of acidity or alkalinity of a soil, expressed in pH values. The pH value and terms used to describe soil reaction are explained in the Glossary.

Salinity refers to the amount of soluble salts in the soil, It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25° C. Salinity affects the suitability of a soil for crops, its stability when used as construction material, and the risk of corrosion of the soil to metals and concrete.

Shrink-swell potential is the relative change in volume to be expected with changes in moisture content, that is, the extent to which the soil shrinks as it dries out or swells when it gets wet. Extent of shrinking and swelling is influenced by the amount and kind of clay in the soil. Shrinking and swelling of soils causes much damage to building foundations, roads, and other structures. A *high* shrink-swell potential indicates a hazard to maintenance of structures built in, on, or with material having this rating.

The risk of corrosion, as used in table 5, pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. Rate of corrosion on uncoated steel is related to soil properties, such as drainage, texture, total acidity, and electrical conductivity of the soil material. The rate of corrosion on concrete is influenced mainly by the content of soduim or magnesium sulfate, but also by soil texture and acidity. Installations of uncoated steel that intersect soil boundaries or soil horizons are more susceptible to corrosion than installations entirely in one kind of soil or in one soil horizon. A corrosion rating of *low* indicates a low probability of soil-induced corrosion damage. A rating of *high* indicates a high probability of damage, so that protective measures for steel and more resistant concrete should be used to avoid or minimize damage.

Engineering interpretations

The interpretations in table 6 are based on the engineering properties of soils shown in table 5, on test data for soils in this survey area and others nearby or adjoining, and on the experience of engineers and soil scientists with the soils of the survey area. Ratings in table 6 summarize the limitation or suitability of the soils for all listed purposes but pond reservoir areas, embankments, dikes, and levees.

Limitations are expressed as slight, moderate, severe, and very severe. *Slight* indicates soil properties generally favorable for the rated use, or limitations that are minor and easily overcome. *Moderate* means that some properties are unfavorable, but can be overcome or modified by special planning and design. *Severe* indicates soil properties so unfavorable and so difficult to correct or overcome that major soil reclamation, special design, or intensive maintenance is required. *Very severe* indicates one or more soil properties so unfavorable for a particular use that overcoming the limitations is most difficult and costly and is commonly not practical for the rated use.

Suitability is expressed as good, fair, and poor, which have, respectively, meanings approximately parallel to the terms slight, moderate, and severe.

Following are explanations of some of the columns in table 6.

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into natural soil. The soil material from a depth of 18 inches to 6 feet is evaluated. The soil properties considered are those that affect both absorption of effluent and construction and operation of the system. Properties that affect absorption are permeability, depth to water table or rock, and susceptibility to flooding. Slope is a soil property that affects difficulty of layout and construction and also the risk of soil erosion, lateral seepage, and downslope flow of effluent. Large rocks or boulders increase construction costs.

Sewage lagoons are shallow ponds constructed to hold sewage within a depth of 2 to 5 feet long enough for bacteria to decompose the solids. A lagoon has a nearly level floor and sides, or embankments, of compacted soil material. It is assumed that the embankment is compacted to medium density and the pond is protected from flooding. Properties that affect the pond floor and the embankment are considered. Those that affect the pond floor are permeability, content of organic matter, and slope. If the floor needs to be leveled, depth to bedrock becomes important. The soil properties that affect the embankment are the engineering properties of the embankment material as interpreted from the Unified Soil Classification and the number of stones, if any, that influence the ease of excavation and compaction of the embankment material.

Shallow excavations are those that require digging or trenching to a depth of less than 6 feet, as for example, excavations for pipelines, sewer lines, phone and power transmission lines, basements, open ditches, and cemeteries. Desirable soil properties are good workability, moderate resistance to sloughing, gentle slopes, absence of rock outcrops or big stones, and no flooding, and no high water table.

Dwellings without basements, as rated in table 6, are no more than three stories high and are supported by foundation footings placed in undisturbed soil. The features that affect use of a soil for dwellings are those that relate to capacity to support load and resist settlement under load and those that relate to ease of excavation. Soil properties that affect capacity to support load are wetness, susceptibilty to flooding, density, plasticity, texture, and shrink-swell potential. Those that affect excavation are wetness, slope, depth to bedrock, and content of stones and rocks.

Sanitary landfill is a method of disposing of refuse in dug trenches. The waste is spread in thin layers and compacted and then covered with soil throughout the disposal period. Landfill areas are subject to heavy vehicular traffic. Some soil properties that affect suitability for landfill are ease of excavation, hazard of polluting ground water, and trafficability. The best soils have moderately slow permeability, withstand heavy traffic, and are friable and easy to excavate. Unless otherwise stated, the ratings in table 6 apply only to a depth of about 6 feet; therefore, a limitation rating of *slight* or *moderate* may not be valid if the trench is to be much deeper than 6 feet. For some soils, reliable predictions can be made to a depth of 10 to 15 feet, but regardless of that, every site should be investigated before it is selected.

Local roads and streets, as rated in table 6, have an all-weather surface expected to carry automobile traffic all year. They have a subgrade of underlying soil material; a base consisting of gravel, crushed rock, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. These roads are graded to shed water and have ordinary provisions for drainage. They are built mainly from soil at hand, and most cuts and fills are less than 6 feet deep.

Soil properties that most affect design and construction of roads and streets are load-supporting capacity and stability of the subgrade and the workability and quantity of cut and fill material available. The AASHTO and Unified classifications of the soil material, and also the shrink-swell potential, indicate traffic-supporting capacity. Wetness and flooding affect stability of the material. Slope, depth to hard rock, content of stones and rocks, and wetness affect ease of excavation and the amount of cut and fill needed to reach an even grade.

Road fill is soil material used in embankments for roads. The suitability ratings reflect the predicted performance of soil after it has been placed in an embankment that has been properly compacted and provided with adequate drainage and the relative ease of excavating the material at borrow areas.

Sand is used in great quantities in many kinds of construction. The ratings in table 6 provide guidance about where to look for probable sources. A soil rated as a *good* or *fair* source of sand generally has a layer at least 3 feet thick, the top of which is within a depth of 6 feet. The ratings do not take into account thickness of overburden, location of the water table, or other factors that affect mining of the materials. Neither do they indicate quality of the deposit.

Topsoil is used for topdressing an area where vegetation is to be established and maintained. Suitability is affected mainly by ease of working and spreading the soil material, as in preparing a seedbed; natural fertility of the material, or the response of plants when fertilizer is applied; and absence of substances toxic to plants. Texture of the soil material and its content of stone fragments are characteristics that affect suitability, but also considered in the ratings is damage that will result at the area from which topsoil is taken.

Pond reservoir areas hold water behind a dam or embankment. Soils suitable for pond reservoir areas have low seepage, which is related to their permeability and depth to fractured or permeable bedrock or other permeable material.

Embankments, dikes, and levees require soil material resistant to seepage and piping and of favorable stability, shrink-swell potential, shear strength, and compactibility. Stones or organic material in a soil are among factors that are unfavorable.

Recreation

Knowledge of soils is necessary in planning, developing, and maintaining areas used for recreation. In table 7 the soils of the survey area are rated according to limitations that affect their suitability for camp areas, playgrounds, picnic areas, and paths and trails, and lawn and golf fairways.

In table 7 the soils are rated as having slight, moderate, or severe limitations for the specified uses. For all of

TABLE 7.—*Soil limitations for*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils for referring to other series that

Soil series and map symbols	Camp areas	Picnic areas
Agualt: Aa	Severe: flooding	Moderate: flooded for short periods
*Antho: AbA, AbB, Ac, Ae, AfA, AfB, AGB, AHC, AkB, AL, AM. For Carrizo part of AfA, AfB, AGB; Tremant part of AkB, AHC; Brios part of Ae; Mohall part of AkB; and Valencia part of AM; see their respective series.	Slight	None to slight
AdA, AdB	Moderate: 20 to 50 percent gravel	Moderate: 20 to 50 percent gravel
Avonda: An	Moderate: clay loam surface layer	Moderate: clay loam surface layer
Avondale: Ao, Ap	Moderate: clay loam surface layer	Moderate: clay loam surface layer
Beardsley: BE	Moderate: slow permeability	None to slight
Brios: Br, Bs, Bt	Severe: flooding	None to slight
*Carrizo: Cb, CeD, CF For Ebon part of CeD and Brios part of CF, see their respective series.	Severe: flooding; gravelly	Severe: flooding
*Casa Grande: Cg, Ch, Ck, Cm For Laveen part of Cm, see Laveen series.	Moderate: slow permeability	Slight
Cashion: Cn	Severe: clay surface layer; flooding	Severe: clay surface layer
*Cherioni: CO For Rock outcrop part, see Rock outcrop.	Severe: more than 50 percent coarse fragments; slope; bedrock at a depth of less than 20 inches.	Severe: more than 50 percent coarse fragments; bedrock at a depth of less than 20 inches.
*Coolidge: Cp, CrB, Cs, CV For Tremant part of Cs and Laveen part of CV, see their respective series.	Slight for Cp, Cs, CV. Moderate for CrB: 20 to 50 percent gravel.	Slight for Cp, Cs, CV. Moderate for CrB: 20 to 50 percent gravel.
Dune land: Dn. No valid ratings can be made.		
*Ebon: EbD, EPD For Pinamt part of EPD, see Pinamt series.	Severe: 50 to 90 percent gravel and cobbles.	Severe: 50 to 90 percent gravel and cobbles.
Estrella: Es, Et	Slight	Slight
*Gachado: GA Rock outcrop part is not rated.	Severe: more than 50 percent gravel and cobbles; bedrock at a depth of less than 20 inches.	Severe: more than 50 percent gravel and cobbles; bedrock at a depth of less than 20 inches.
Gadsden: Gb, Gc, Gd	Severe: slow permeability; flooding in some areas.	Moderate for Gb: clay loam surface layer. Severe for Gc, Gd: clay surface layer.

these ratings, it is assumed that a good cover of vegetation can be established and maintained. A limitation of *slight* means that soil properties are generally favorable and limitations are so minor that they easily can be overcome. A *moderate* limitation can be overcome or modified by planning, by design, or by special maintenance. A *severe* limitation means that costly soil reclamation, special design, intense maintenance, or a combination of these, is required.

Camp areas are used intensively for tents and small camp trailers and the accompanying activities of outdoor living. Little preparation of the site is required, other than shaping and leveling for tent and parking areas. Camp areas are subject to heavy foot traffic and limited vehicular traffic. The best soils have mild slopes, good drainage, a surface that is free of rocks and coarse fragments and is firm after rains but not dusty when dry; and are not flooded during periods of heavy use.

recreational facilities

in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions appear in the first column of this table]

Playgrounds	Paths and trails	Lawns and golf fairways
Moderate: flooded for short periods	None to slight	None to slight if protected. Moderate to severe if flooded.
None to slight	None to slight	None to slight.
Severe: 20 to 50 percent gravel	Moderate: 20 to 50 percent gravel	Moderate: 20 to 50 percent gravel.
Moderate: clay loam surface layer	Moderate: clay loam surface layer	Moderate: clay loam surface layer.
Moderate: clay loam surface layer	Moderate: clay loam surface layer	Moderate: clay loam surface layer. Moderate to severe for saline-alkali phase of Ap.
Moderate: slow permeability	None to slight	Severe: slow permeability.
Moderate: flooding	None to slight	Severe: flooding. Moderate if protected from flooding: rapid permeability.
Severe: flooding; 20 to 50 percent gravel	Severe: flooding	Severe: low available water capacity; flooding.
Moderate: slow permeability	Slight	Severe: saline-alkali; slow permeability.
Severe: clay surface layer; flooding	Severe: clay surface layer	Moderate: clay surface layer; occasionally flooded; saline-alkali.
Severe: more than 50 percent coarse fragments; bedrock at a depth of less than 20 inches.	Severe: shallow soil; more than 50 percent coarse fragments; bedrock at a depth of less than 20 inches.	Severe: steep slope; more than 50 percent gravel and cobbles; bedrock at a depth of less than 20 inches.
Slight for Cp, Cs, CV. Moderate for CrB: 20 to 50 percent gravel.	Slight for Cp, Cs, CV. Moderate for CrB: 20 to 50 percent gravel.	Slight for Cp, Cs, CV. Moderate for CrB: 20 to 50 percent gravel.
Severe: more than 50 percent gravel and cobbles.	Severe: 50 to 90 percent gravel and cobbles	Severe: 50 to 90 percent gravel and cobbles; slow permeability.
Slight	Slight	Slight for Es. Moderate for Et: saline-alkali.
Severe: more than 20 percent gravel and cobbles; bedrock at a depth of less than 20 inches.	Severe: more than 50 percent gravel and cobbles; bedrock at a depth of less than 20 inches.	Severe: more than 50 percent gravel and cobbles; bedrock at a depth of less than 20 inches.
Severe: clay surface layer; slow permeability.	Moderate for Gb: clay loam surface layer. Severe for Gc and Gd: clay surface layer.	Severe: clay surface layer; slow permeability; saline-alkali for Gd; rare brief flooding in some areas.

TABLE 7.—*Soil limitations for*

Soil series and map symbols	Camp areas	Picnic areas
*Gilman: Ge, Gf, GgA, GgB, Gh, and parts of GL, GM, GN, and Go3. For Antho part of GM, Laveen part of GN and Antho and Glenbar parts of Go3, see their respective series.	Slight	Slight
Gilman variant: Gp	Moderate: slow permeability	Slight
Glenbar: Gr, Gs, Gt, Gu, Gv	Moderate for Gr, Gs, Gt, and Gu: clay loam surface layer; moderately slow permeability. Severe for Gv: clay surface layer.	Slight for Gr and Gs: loam surface layer. Moderate for Gt and Gu: clay loam surface layer.
*Gunsight: GWD, GxA, GxB, GYD For Pinal part of GWD and Rillito part of GxA, GxB, and GYD, see their respective series.	Moderate: 20 to 50 percent gravel	Moderate: 20 to 50 percent gravel
*Harqua: HAB, HAC, HLC, HM, HrB For Gunsight part of HLC, Laveen part of HM, and Rillito part of HrB, see their respective series.	Moderate: 20 to 50 percent gravel	Moderate: 20 to 50 percent gravel
La Palma: La	Moderate: slow permeability; hardpan at a depth of 20 to 40 inches.	Slight
*Laveen: Lb, LcA, LcB, Ld, Le, Lf For Antho part of Lf, see Antho series.	Slight	Slight
Maripo: Ma	Slight	Slight
*Mohall: Mo, Mp, Mr, Ms, MTB, MV For Tremant part of MTB and Laveen part of MV, see their respective series.	Moderate: moderately slow permeability.	Slight
*Perryville: Pa, Pb, PeA, PeB, PRB For Rillito part of PRB, see Rillito series.	Moderate: 20 to 50 percent gravel	Moderate: 20 to 50 percent gravel
*Pinal: PsA, PsB, PT, PvB, PWB For La Palma part of PvB and Suncity part of PWB, see their respective series.	Severe: very slow permeability; hardpan at a depth of less than 20 inches.	Slight for PsA, PsB, PvB, PWB. Moderate for PT: 20 to 50 percent gravel; hardpan at a depth of less than 20 inches.
*Pinamt: PYD For Tremant part, see Tremant series.	Severe: more than 50 percent coarse fragments.	Severe: more than 50 percent coarse fragments.
*Rillito: RaA, RaB, RbA, RbB, RhB, RpE For Harqua part of RhB and Perryville part of RpE, see their respective series.	Slight for RaA, RaB, RbA, and RbB. Moderate for RhB and RpE: 20 to 50 percent gravel.	Slight for RaA, RaB, RbA, and RbB. Moderate for RhB, RpE: 20 to 50 percent gravel.
*Rock outcrop: RS. Rock outcrop is too variable to rate. For Cherioni part, see Cherioni series. Severe limitation for most uses.		
Suncity Mapped only with Pinal soil.	Severe: more than 50 percent coarse fragments; very slow permeability; hardpan at a depth of less than 20 inches.	Severe: more than 50 percent coarse fragments; hardpan at a depth of 20 inches.
Toltec: Ta	Moderate: slow permeability	Slight
Torrifluvents: TB. Too variable to be rated.		
Torriorthents: Tc. Too variable to be rated.		
*Torripsamments: TD. For Torrifluvents part, see Torrifluvents. Too variable to be rated.		

recreational facilities—Continued

Playgrounds	Paths and trails	Lawns and golf fairways
Slight	Slight	Slight for Ge, GgA, GgB, GM, GN. Moderate to severe for Gf, Gh, GL, and Go3: saline-alkali.
Moderate: slow permeability	Slight	Severe: saline-alkali.
Moderate: clay loam surface layer; moderately slow permeability. Severe for Gv: clay surface layer.	Slight for Gr and Gs: loam surface layer. Moderate for Gt and Gu: clay loam surface layer. Severe for Gv: clay surface layer.	Moderate for Gr, Gt, and Gv: loam, clay loam, and clay surface layer; moderately slow permeability. Severe for saline-alkali phases of Gs and Gu.
Severe: more than 20 percent gravel	Moderate: 20 to 50 percent gravel	Moderate: 20 to 50 percent gravel; low available water capacity.
Severe: more than 20 percent gravel	Moderate: 20 to 50 percent gravel	Severe: excess salts.
Moderate: slow permeability; hardpan at a depth of 20 to 40 inches.	Slight	Severe: slow permeability; hardpan at a depth of 20 to 40 inches; alkali.
Slight	Slight	Slight. Moderate for saline and alkali phases.
Slight	Slight	Slight: sand or gravelly loamy sand at a depth of 20 to 40 inches.
Moderate: moderately slow permeability	Slight	Moderate: moderately slow permeability.
Severe: more than 20 percent gravel	Moderate: 20 to 50 percent gravel	Moderate: excessive amounts of lime; Pb is saline-alkali.
Severe: hardpan at a depth of less than 20 inches; more than 20 percent gravel in PT.	Slight for PsA, PsB, PvB, PWB. Moderate for PT: 20 to 50 percent gravel; hardpan at a depth of less than 20 inches.	Severe: hardpan at a depth of less than 20 inches; poor available water capacity.
Severe: more than 50 percent coarse fragments.	Severe: more than 50 percent coarse fragments.	Severe: more than 50 percent coarse fragments.
Slight for RaA, RaB, RbA, and RbB. Severe for RhB and RpE: more than 20 percent gravel.	Slight for RaA, RaB, RbA, and RbB. Moderate for rest: 20 to 50 percent gravel.	None to slight for RaA, RaB, RbA, and RbB. Moderate for rest: 20 to 50 percent gravel.
Severe: more than 50 percent coarse fragments; hardpan at a depth of less than 20 inches.	Severe: more than 50 percent coarse fragments; hardpan at a depth of less than 20 inches.	Severe: hardpan at a depth of less than 20 inches; more than 50 percent coarse fragments; excess salts in some areas.
Moderate: slow permeability	Slight	Severe: slow permeability; weakly or strongly cemented hardpan at a depth of 20 to 40 inches.

TABLE 7.—*Soil limitations for*

Soil series and map symbols	Camp areas	Picnic areas
*Tremant: Te, TfA, TfB, Tg, Th, TPB, TrA, TrB, TSC. For Rillito part of TrA, TrB, and TSC, see Rillito series.	Moderate: 20 to 50 percent coarse fragments; slow permeability.	Slight for Te. Moderate for rest: 20 to 50 percent coarse fragments; clay loam surface layer in Tg.
Trix: Tt	Moderate: clay loam; moderately slow permeability.	Moderate: clay loam
Tucson: Tu, Tw	Moderate: moderately slow permeability; Tw has a clay loam surface layer.	Slight for Tu. Moderate for Tw: clay loam
Valencia: Va, Vb	Slight	Slight
Vc	Moderate: 20 to 50 percent gravel	Moderate: 20 to 50 percent gravel
Vecont: Ve, Vf	Moderate for Ve: slow permeability; loam. Severe for Vf: clayey.	Slight for Ve: loam. Severe for Vf: clayey.
*Vint: Vg, Vh, Vk, Vn, Vr. For Carrizo part, see Carrizo series.	Slight for Vh and Vk. Moderate for Vg and Vn: loamy fine sand and clay loam.	Slight for Vh and Vk. Moderate for Vg and Vn: loamy fine sand and clay loam.
Wintersburg: Wg	Moderate: clay loam surface layer; moderately slow permeability. Severe: clay member of complex.	Moderate: clay loam surface layer. Severe: clay member of complex.

Picnic areas are attractive natural or landscaped tracts used primarily for preparing meals and eating outdoors. These areas are subject to heavy foot traffic. Most of the vehicular traffic is confined to access roads. The best soils are firm when wet but not dusty when dry; are not flooded during the season of use; and do not have slopes or stones that greatly increase cost of leveling sites or of building access roads.

Playgrounds are areas used intensively for baseball, football, badminton, and similar organized games. Soils suitable for this use need to withstand intensive foot traffic. The best soils have a nearly level surface free of coarse fragments and rock outcrops; have good drainage and a surface that is firm after rain, but not dusty when dry; and are not flooded during periods of heavy use. If grading and leveling are required, depth to rock is important.

Paths and trails are used for local and cross-country travel by foot or horseback. Design and layout should require little or no cutting and filling. The best soils are at least moderately well drained, are firm when wet but not dusty when dry, are flooded not more than once during the season of use, have slopes of less than 15 percent, and have few or no rocks or stones on the surface.

Lawns and golf fairways are affected by such soil properties as slope, drainage, frequency of flooding, stoniness, and texture of the surface layer. Traps and roughs are not considered part of the fairway.

Trees and Shrubs [6]

This part of the survey provides a guide to homeowners for selecting tree and shrub plantings according to kinds of soil. General suggestions on planting are listed in table 8. The table also shows the suitability of plants on specific kinds of soil. It lists most of the trees and shrubs commonly grown in the area and the limitations by soil groups for growth of the specified plantings.

Each soil in the survey area is assigned to one of seven horticultural groups. The soils in each group are similar and have similar effect on the growth of specified plantings. Criteria for the soil groupings follow:

Group 1. Soils have few limitations to plant growth.
Group 2. Soils are moderately deep over concentrations of lime, which causes chlorosis in susceptible plants.
Group 3. Soils are clayey and are easily waterlogged, both of which can cause chlorosis in plants.
Group 4. Soils are sandy and droughty.
Group 5. Soils are slightly to strongly saline and alkaline.

[6] Prepared by WILLIAM BENDER, horticulturist, Phoenix Parks and Recreation Department, Phoenix; CHARLES SACAMANO, extension horticulturist, Agricultural Extension Service, Tucson; LOWELL TRUE, extension specialist, Agricultural Extension Service, Phoenix; JAMES WHEAT, president, Arizona Nurserymans Association, Phoenix; CHRISTOPHER P. WILLIAMS, district conservationist, Soil Conservation Service, Chandler.

recreational facilities—Continued

Playgrounds	Paths and trails	Lawns and golf fairways
Severe: more than 20 percent gravel; slow permeability.	Slight for Te. Moderate for rest: 20 to 50 percent coarse fragments; clay loam surface layer in Tg.	Moderate: 20 to 50 percent gravel; slow permeability.
Moderate: clay loam; moderately slow permeability.	Moderate: clay loam	Moderate: clay loam; moderately slow permeability.
Moderate: moderately slow permeability; Tw has a clay loam surface layer.	Slight for Tu. Moderate for Tw: clay loam.	Moderate: moderately slow permeability; Tw has a clay loam surface layer.
Slight Severe: more than 20 percent gravel	Slight Moderate: 20 to 50 percent gravel	None to slight. Moderate: 20 to 50 percent gravel.
Moderate for Ve: loam; slow permeability. Severe for Vf: clayey.	Slight for Ve: loam surface layer. Severe for Vf: clayey.	Severe: slow permeability; Vf has clayey surface layer.
Slight for Vh and Vk. Moderate for Vg and Vn: loamy fine sand and clay loam.	Slight for Vh and Vk. Moderate for Vg and Vn: loamy fine sand and clay loam.	Slight for Vh and Vk. Moderate for Vg and Vn: loamy fine sand and clay loam.
Moderate: clay loam surface layer; moderately slow permeability. Severe: clay member of complex.	Moderate: clay loam surface layer Severe: clay member of complex.	Moderate: clay loam and clay; moderately slow permeability.

Group 6. Soils are gravelly and are shallow over lime, which causes chlorosis in susceptible plants.

Group 7. Soils have a shallow to moderately deep, restricted root zone.

Each soil group is described on the pages that follow. To facilitate use of this information, locate your home or farm on the detailed soil map at the back of this publication. The symbol on the soil map represents the kind of soil. Locate this symbol in the guide to mapping units. Across from the symbol is listed the horticultural group to which this kind of soil has been assigned. Then refer to table 8 to determine the suitability of specified plantings on the particular soil.

Irrigation.—The most common reason for unhealthy plants is poor irrigation. The home gardener should become familiar with the soil he is working with and the rooting system of the plant. The general rooting depth is given for each kind of plant listed in table 8. Most trees and shrubs take 50 to 75 percent of their water from the upper 2 to 3 feet of soil. Because irrigation is shallow in places, many plants never develop a root system below the upper foot of soil. These are the shallow-rooted trees that are easily toppled by wind and require frequent irrigation. Most irrigation water, however, carries salts, which accumulates in the root zone if all irrigations are shallow. At least one deep irrigation per year, therefore, is needed to remove salts from the root zone. Soils differ in their ability to take and hold water and in the depth to which irrigation water penetrates. A soil probe that reaches below a depth of 3 feet is useful in determining the depth to which moisture has penetrated. General suggestions about how much water to apply are given in the description of each horticultural group. This information is intended as a guide and should be replaced by personal knowledge as further experience is gained.

Fertilization.—Suggestions on fertilization are general because of the many variations in soils and in plant response. More specific information can be obtained from a qualified nurseryman or the county extension agent. Most trees and shrubs suited to this area benefit from applications of nitrogen. Phosphorus and occasionally iron are needed on some soils, especially those high in content of lime. Soil amendments, such as gypsum, can increase water penetration in soils high in content of saline or alkali salts or both.

Exposure.—Plants vary in their need for sunlight. The sides of a house provide four different climates. A plant needing shade should be planted on the north side, and a plant needing full sunlight should be planted on the south side. Plants that tolerate either shade or full sunlight can be planted on the east or west side. Frost-sensitive varieties ordinarily do well in covered areas, such as patios. The desirable exposure for each plant is given in table 8.

Site preparation.—When planting a tree or shrub, a hole much larger than the root ball should be excavated. Because all soils in the survey area are low in content of organic matter, some modification of the site is desirable. Peat moss, manure, straw, or other organic matter should be mixed with the soil before planting. Many building and home sites contain buried building materials, such as gypsum board, sheets of plastic, concrete blocks, and cement, that restrict root growth and therefore should be

TABLE 8.—*Tree and shrub planting guide*

EVERGREEN SHRUBS (ROOT DEPTH 2 TO 2½ FEET)

Common and botanical names	Characteristics of plantings	Limitation of soils for plant growth[1]						
		Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7
Abelia *Abelia grandiflora.*	Sunny sites; 4 to 8 feet high; 3 to 6 feet wide; evergreen foliage; low salt tolerance.	Slight	Moderate	Moderate	Moderate	Severe	Moderate	Severe.
Bottlebrush *Callistemon* sp.	Sunny sites; 6 to 8 feet high; 4 to 6 feet wide; light green foliage; red flower April to June; highly susceptible to chlorosis.	Slight	Moderate	Moderate	Slight	Severe	Moderate	Severe.
Boxwood *Buxus* sp.	Shady sites; 2 to 4 feet high; 1 to 2 feet wide; light green foliage; highly susceptible to nematodes.	Slight	Moderate	Moderate	Moderate	Severe	Moderate	Moderate.
Chinese photinia *Photinia serrulata.*	Shady sites; 6 to 10 feet high; 8 to 10 feet wide; green to bronze foliage; red berries in fall; moderately susceptible to chlorosis.	Slight	Moderate	Moderate	Slight	Moderate	Moderate	Severe.
Honeysuckle, Cape *Tecomaria capensis.*	Sunny sites; 6 to 8 feet high; 3 to 5 feet wide; green foliage; orange and red flowers October to April; strongly chlorotic if overwatered.	Slight	Moderate	Severe	Moderate	Severe	Moderate	Moderate.
Cassia, feathery *Cassia artemisioides.*	Sunny sites; 6 to 8 feet high; 5 to 8 feet wide; feathery, gray foliage; yellow flower January to April; root fungi; chlorotic if overwatered.	Slight	Moderate	Moderate	Slight	Moderate	Moderate	Severe.
Cassia, golden wonder senna *Cassia splendida.*	Sunny sites; 6 to 10 feet high; 8 to 12 feet wide; green foliage; yellow flower October to December; chlorotic if overwatered.	Slight	Moderate	Moderate	Slight	Moderate	Moderate	Severe.
Cocculus *Cocculus laurifolius.*	Partially shady sites; 6 to 8 feet high; 6 to 8 feet wide; green foliage; occasional root rot.	Slight	Moderate	Moderate	Moderate	Moderate	Moderate	Severe.
Cotoneaster *Cotoneaster.*	Sunny sites; 2½ to 4 feet high; 3 to 5 feet wide; gray-green foliage; red berries in fall; occasional root rot.	Slight	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate.
Euonymus *Euonymus japonica* var.	Shady sites; 3 to 8 feet high; 6 feet wide; green or variegated foliage; powdery mildew serious; chlorotic if overwatered.	Slight	Moderate	Moderate	Slight	Severe	Moderate	Severe.
Gardenia *Gardenia jasminoides.*	Shady sites; 2 to 3 feet high; 1 to 2 feet wide; light green foliage; white flower April to May; strongly chlorotic if overwatered; occasional nematodes.	Moderate	Severe	Severe	Moderate	Severe	Severe	Moderate.
Hibiscus *Hibiscus* sp.	Sunny sites; 4 to 8 feet high; 6 to 8 feet wide; green or variegated foliage; multicolored flower in spring; strongly chlorotic if overwatered; frost tender; susceptible to root rot.	Slight	Severe	Severe	Moderate	Severe	Severe	Severe.

See footnote at end of table.

TABLE 8.—*Tree and shrub planting guide*—Continued

EVERGREEN SHRUBS—Continued

Common and botanical names	Characteristics of plantings	Limitation of soils for plant growth[1]						
		Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7
Holly, Chinese *Ilex cornuta* var.	Partially shady sites; 4 to 6 feet high; 3 to 5 feet wide; green or variegated foliage; red berries in fall; strongly chlorotic if overwatered; moderately susceptible to root rot.	Slight	Severe	Severe	Moderate	Severe	Severe	Severe.
Hopseed *Dodonaea viscosa.*	Partially shady sites; 6 to 8 feet high; 6 to 10 feet wide; foliage red, purple in winter; moderately susceptible to chlorosis; occasional root rot.	Slight	Moderate	Moderate	Slight	Severe	Moderate	Severe.
Jasmine, primrose *Jasminum mesnyi.*	Sunny sites; 3 to 5 feet high; 4 to 6 feet wide; dark green foliage; yellow flower in March; occasional nematodes; semi-frost tender.	Slight	Moderate	Moderate	Moderate	Severe	Moderate	Moderate.
Myrtle *Myrtus communis* var.	Sunny sites; 4 to 8 feet high; 4 to 5 feet wide; green foliage; white flower in April; strongly chlorotic; frequent root rot.	Slight	Moderate	Moderate	Slight	Severe	Moderate	Severe.
Bamboo, heavenly *Nandina domestica.*	Partially shady sites; 3 to 5 feet high; 1 to 2 feet wide; bronze foliage in fall and winter; strongly chlorotic; moderately susceptible to nematodes.	Slight	Moderate	Moderate	Moderate	Severe	Moderate	Moderate.
Natal plum *Carissa grandiflora.*	Sunny sites; 1 to 6 feet high; 2 to 4 feet wide; dark green foliage; white flower from March to May; chlorotic if overwatered; frost tender.	Slight	Moderate	Moderate	Slight	Moderate	Moderate	Moderate.
Oleander *Nerium oleander* var.	Sunny sites; 6 to 15 feet high; 8 to 15 feet wide; green or variegated foliage; multicolored flower May to September; root rot; highly competitive to nearby plants; invades sewer lines.	Slight	Slight	Slight	Moderate	Moderate	Slight	Moderate.
Yellow oleander *Thevetia peruviana.*	Sunny sites; 6 to 8 feet high; 5 to 10 feet wide; light green foliage; yellow flower June to November; frost tender; semi-chlorosis susceptible.	Slight	Moderate	Moderate	Slight	Moderate	Moderate	Moderate.
Pittosporum *Pittosporum tobira* var.	Shady sites; 5 to 8 feet high; 4 to 8 feet wide; green or variegated foliage; white flower early in spring; occasional mildew; semi-frost tender.	Slight	Moderate	Moderate	Slight	Severe	Moderate	Severe.
Podocarpus (Yew pine) *Podocarpus macrophyllus* var.	Shady sites; 3 to 5 feet high; 2 to 4 feet wide; light green foliage; moderately susceptible to chlorosis.	Slight	Moderate	Moderate	Slight	Severe	Moderate	Moderate.
Plumbago *Plumbago auriculata* var.	Sunny sites; 3 to 4 feet high; 4 to 6 feet wide; light green foliage; blue flower June to October; chlorotic if overwatered.	Slight	Moderate	Moderate	Slight	Severe	Moderate	Moderate.
Pomegranate, dwarf.	Sunny sites; 2 to 4 feet high; 3 to 6 feet wide; foliage	Slight	Moderate	Moderate	Slight	Moderate	Moderate	Moderate.

See footnote at end of table.

TABLE 8.—*Tree and shrub planting guide*—Continued

EVERGREEN SHRUBS—Continued

Common and botanical names	Characteristics of plantings	Limitation of soils for plant growth[1]						
		Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7
Punica granatum	dark green, yellow in fall; orange flower June to August; moderately susceptible to chlorosis.							
Privet, Japanese *Ligustrum japonicum* var.	Sunny sites; 5 to 10 feet high; 4 to 8 feet wide; medium green foliage; suceptible to salts; highly susceptible to nematodes.	Slight	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate.
Pyracantha *Pyracantha* sp.	Sunny sites; 2 to 10 feet high; 5 to 15 feet wide; green foliage; white flower March to April, red berries in winter; strongly chlorotic; occasional root rot.	Slight	Moderate	Moderate	Slight	Severe	Moderate	Severe.
Raphiolepis *Raphiolepis indica* var.	Shady sites; 2 to 4 feet high; 1 to 3 feet wide; light green foliage; pink to rose flower in spring; moderately susceptible to chlorosis.	Slight	Moderate	Moderate	Slight	Severe	Moderate	Moderate.
Silverberry *Elaeagnus pungens* var.	Sunny sites; 5 to 7 feet high; 4 to 8 feet wide; silvery foliage; red berries in fall; should not be overwatered.	Slight	Moderate	Moderate	Slight	Severe	Moderate	Moderate.
Citrus, ornamental *Citrus* sp.	Sunny sites; 8 to 12 feet high; 6 to 12 feet wide; green foliage; white flower in spring; moderately susceptible to chlorosis.	Slight	Moderate	Moderate	Slight	Severe	Moderate	Severe.
Texas mountain laurel *Sophora secundiflora.*	Sunny sites; 6 to 8 feet high; 5 to 10 feet wide; light green foliage; flower violet, blue in spring; moderately susceptible to chlorosis.	Slight	Moderate	Moderate	Slight	Moderate	Moderate	Severe.
Texas ranger *Frutescens leucophyllum.*	Sunny sites; 4 to 5 feet high; 2 to 4 feet wide; gray to silver foliage; lavender flower May to August; occasional root rot.	Slight	Slight	Slight	Slight	Moderate	Slight	Severe.
Viburnum *Viburnum suspensum.*	Shady sites; 4 to 6 feet high; 4 to 8 feet wide; green or variegated foliage; Creamy flower February to March; moderately susceptible to chlorosis; occasional mildew.	Slight	Moderate	Moderate	Moderate	Severe	Moderate	Severe.
Viburnum *Viburnum tinus* var. Robustum'.	Shady sites; 5 to 8 feet high; 3 to 5 feet wide; green or variegated foliage; pinkish flower January to March; moderately susceptible to chlorosis; occasional mildew.	Slight	Moderate	Moderate	Moderate	Severe	Moderate	Severe.
Xylosma *Xylosma congestum.*	Sunny sites; 8 to 10 feet high; 8 to 15 feet wide; yellow-green foliage; susceptible to chlorosis; susceptible to root rot.	Slight	Moderate	Moderate	Moderate	Severe	Moderate	Severe.
Yucca *Yucca* sp.	Sunny sites; 3 to 6 feet high; 3 to 5 feet wide; green or variegated foliage; white flower in May; leaf blight.	Slight	Slight	Slight	Slight	Moderate	Slight	Moderate.

See footnote at end of table.

TABLE 8.—*Tree and shrub planting guide*—Continued

CONIFEROUS EVERGREENS (ROOT DEPTH 2½ TO 6 FEET)

Common and botanical names	Characteristics of plantings	Limitation of soils for plant growth [1]						
		Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7
Arborvitae, Baker (compact) *Platycladus orientalis* var. 'Bakeri'.	Sunny sites; 4 to 12 feet high; 2 to 10 feet wide; green or yellow foliage; compact to tall cone form; nitrogen sensitive; moderately chlorotic; red spider mites often a problem.	Slight	Moderate	Moderate	Slight	Severe	Moderate	Severe.
Cypress, Italian *Cupressus sempervirens* var.	Sunny sites; 30 feet high; 1 to 3 feet wide; green foliage; tall column form; nitrogen sensitive; red spider mites a constant problem.	Slight	Slight	Moderate	Slight	Moderate	Slight	Severe.
Juniper, Hollywood *Juniperus chinensis* var. 'Torulosa'.	Sunny sites; 8 to 10 feet high; 3 to 6 feet wide; rich green foliage; twisted columnar form; nitrogen and salts sensitive; mites often a problem.	Slight	Moderate	Moderate	Slight	Severe	Moderate	Severe.
Juniper, Pfitzer *Juniperus chinensis* var. 'Pfitzeriana'.	Sunny sites; 4 to 6 feet high; 8 to 15 feet wide; gray-green feathery foliage; upright, spreading form; nitrogen and salts sensitive; mites often a problem.	Slight	Slight	Moderate	Slight	Severe	Slight	Severe.
Juniper, Seagreen *Juniperus* sp.	Sunny sites; 4 to 6 feet high; 3 to 5 feet wide; green foliage; vase form; nitrogen and salts sensitive; mites often a problem.	Slight	Slight	Moderate	Slight	Severe	Slight	Severe.
Juniper, Prostrate *Juniperus horizontalis.*	Partially shady sites; 1 to 2 feet high; 6 to 8 feet wide; green foliage; spreading form; nitrogen and salts sensitive; mites often a problem.	Slight	Slight	Moderate	Slight	Severe	Slight	Moderate
Juniper, Tamarix *Juniperus sabina* var. 'Tamariscifolia'.	Sunny sites; 2 to 3 feet high; 10 to 20 feet wide; blue-green foliage; spreading form; nitrogen and salts sensitive; mites often a problem.	Slight	Slight	Moderate	Slight	Severe	Slight	Moderate
Juniper, Rocky Mountain *Juniperus scopulorum.*	Sunny sites; 10 to 15 feet high; 2 to 4 feet wide; gray-blue to green foliage; upright form; nitrogen and salts sensitive; mites often a problem.	Slight	Moderate	Moderate	Slight	Severe	Moderate	Severe.
Juniper, blue column *Juniperus chinensis* var. 'Columnaris'.	Sunny sites; 20 to 30 feet high; 3 to 5 feet wide; blue-green foliage; columnar form; nitrogen and salts sensitive; mites often a problem.	Slight	Moderate	Moderate	Slight	Severe	Moderate	Severe.
Pine, Aleppo *Pinus halepensis.*	Sunny sites; 40 feet high; 10 to 15 feet wide; light green foliage; open form; salts and nitorgen sensitive; needle blight in fall.	Slight	Moderate	Moderate	Slight	Severe	Moderate	Severe.
Pine, Canary Island *Pinus canariensis.*	Sunny sites; 40 feet high; 10 to 15 feet wide; blue-green to dark foliage; tall layered form; salts and nitrogen sensitive.	Slight	Moderate	Moderate	Slight	Severe	Moderate	Severe.

See footnote at end of table.

TABLE 8.—*Tree and shrub planting guide*—Continued

CONIFEROUS EVERGREENS—Continued

Common and botanical names	Characteristics of plantings	Limitation of soils for plant growth[1]						
		Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7
Crapemyrtle *Lagerstroemia indica.*	Partially shady sites; 10 feet high; 10 feet wide; green foliage; multicolored flower varieties June to September; highly susceptible to chlorosis.	Slight	Moderate	Moderate	Slight	Severe	Moderate	Severe.
NATIVE SHRUBS (ROOT DEPTH 1 TO 3 FEET)								
Beargrass *Nolina Bigelovii.*	Sunny sites; 3 to 6 feet high; 4 to 7 feet wide; light green foliage; white flower June and July; sensitive to overwatering.	Slight	Slight	Slight	Slight	Severe	Slight	Moderate.
Beloperone *Beloperone californica.*	Sunny to partially shady; 3 to 6 feet high; 3 to 5 feet wide; light green foliage; red flower May and June; sensitive to overwatering.	Slight	Moderate	Moderate	Slight	Severe	Moderate	Moderate.
Brickellbush *Brickellia* sp.	Sunny sites; 1 to 3 feet high; 2 to 4 feet wide; yellow, white and purple flower May to September; sensitive to overwatering.	Slight	Slight	Slight	Slight	Moderate	Slight	Moderate.
Brittlebush *Encelia* sp.	Sunny sites; 1½ to 2 feet high; 2 to 4 feet wide; gray foliage; yellow flower April and May; sensitive to overwatering.	Slight	Moderate	Moderate	Slight	Severe	Moderate	Moderate.
Century plant *Agave americana.*	Sunny sites; blue-green foliage, many thorns; yellow flower May to August; sensitive to overwatering.	Slight	Slight	Moderate	Slight	Severe	Slight	Moderate.
Creosotebush *Larrea divaricata.*	Sunny sites; 5 to 11 feet high; 4 to 15 feet wide; gray-green foliage; yellow flower April and May; sensitive to overwatering.	Slight	Slight	Slight	Slight	Moderate	Slight	Moderate.
Indigobush *Dalea* sp.	Sunny sites; 3 to 12 feet high; 5 to 10 feet wide; gray-green foliage; purple flower April to October; sensitive to overwatering.	Slight	Slight	Slight	Slight	Moderate	Slight	Moderate.
Fairy duster *Calliandra eriophylla.*	Sunny sites; ½ to 3 feet high; 3 to 5 feet wide; gray foliage; pink to purple flower March to May; sensitive to overwatering.	Slight	Slight	Slight	Slight	Moderate	Slight	Slight.
Desert honeysuckle *Aniscanthus Thurberi.*	Sunny sites; 2 to 8 feet high; 2 to 6 feet wide; green foliage; orange red flower March to May; sensitive to overwatering.	Slight	Moderate	Moderate	Slight	Severe	Moderate	Moderate.
Jojoba *Simmondsia chinensis.*	Sunny sites; 3 to 7 feet high; 2 to 8 feet wide; leathery gray-green foliage; small yellow flower March to May; sensitive to overwatering.	Slight	Slight	Slight	Slight	Severe	Slight	Moderate.

See footnote at end of table.

TABLE 8.—*Tree and shrub planting guide*—Continued

NATIVE SHRUBS—Continued

Common and botanical names	Characteristics of plantings	Limitation of soils for plant growth [1]						
		Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7
Ocotillo *Fouquieria splendens.*	Sunny sites; 6 to 20 feet high; 5 to 15 feet wide; green foliage; red flower April to June; sensitive to overwatering.	Slight	Slight	Slight	Slight	Severe	Slight	Slight.
Sage *Salvia* sp.	Sunny sites; 2 to 9 feet high; 1 to 8 feet wide; gray foliage; blue to purple flower April to August; sensitive to overwatering.	Slight	Slight	Slight	Slight	Severe	Slight	Moderate.
Saltbush *Atriplex* sp.	Sunny sites; 1 to 6 feet high; 1 to 8 feet wide; gray-green to silvery foliage; gray flower in April to small in May; sensitive to overwatering.	Slight	Slight	Slight	Slight	Slight	Slight	Slight.
Senna *Cassia* sp.	Sunny sites; 2 to 9 feet high; 3 to 14 feet wide; gray foliage; yellow flower April to July; sensitive to overwatering.	Slight	Moderate	Moderate	Slight	Severe	Moderate	Moderate.
Yucca *Yucca* sp.	Sunny to partially shady; 1 to 20 feet high; 2 to 10 feet wide; gray to green foliage; white flower March to June; sensitive to overwatering.	Slight	Moderate	Moderate	Slight	Severe	Moderate	Moderate.
DECIDUOUS SHADE TREES (ROOT DEPTH 8 TO 12 FEET)								
Ash, Arizona *Fraxinus velutina.*	Sunny sites; 50 feet high; 20 to 30 feet wide; light-green foliage; yellow in fall; susceptible to chlorosis, root rot, and nematodes.	Slight	Slight	Moderate	Moderate	Moderate	Moderate	Severe.
Ash, Modesto *Fraxinus velutina* var. 'Modesto'.	Sunny sites; 50 feet high; 25 to 30 feet wide; green and yellow foliage in fall; susceptible to chlorosis, root rot, and nematodes.	Slight	Slight	Moderate	Moderate	Moderate	Moderate	Severe.
Ash, Shamel *Fraxinus uhdei.*	Sunny sites; 40 feet high; 20 to 30 feet wide; green foliage; occasional nematodes and root rot.	Slight	Slight	Slight	Moderate	Moderate	Slight	Severe.
Cottonwood *Populus Fremontii.*	Sunny sites; 50 to 75 feet high; 25 to 35 feet wide; light green foliage, yellow in fall; susceptible to chlorosis, root rot, and slime flux.	Slight	Slight	Moderate	Moderate	Moderate	Moderate	Severe.
Montezuma Cypress *Taxodium mucronatum.*	Sunny sites; 45 feet high; 15 to 20 feet wide; light green foliage; bronze in winter; root rot a problem.	Slight	Moderate	Moderate	Moderate	Moderate	Moderate	Severe.
Elm, Evergreen *Ulmus parvifolia.*	Sunny sites; 30 to 45 feet high; 40 to 60 feet wide; green foliage; occasional nematodes and root rot.	Slight	Slight	Slight	Moderate	Moderate	Moderate	Severe.
Honeylocust, *Gleditsia triacanthos.*	Sunny sites; 40 to 50 feet high; 30 to 45 feet wide; green foliage, yellow in fall; occasional nematodes and root rot.	Slight	Moderate	Moderate	Moderate	Severe	Moderate	Severe.

See footnote at end of table.

TABLE 8.—*Tree and shrub planting guide*—Continued

DECIDUOUS SHADE TREES—Continued

Common and botanical names	Characteristics of plantings	Limitation of soils for plant growth[1]						
		Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7
Silk Tree (Mimosa) *Albizia julibrissin.*	Sunny sites; 12 to 15 feet high; 15 to 25 feet wide; light green foliage; pink flower in summer; leaf hoppers and sooty canker.	Slight	Moderate	Moderate	Slight	Severe	Moderate	Severe.
Mulberry *Morus* sp.	Sunny sites; 40 to 50 feet high; 30 to 45 feet wide; dark green foliage; yellow in fall; root rot, nematodes, sooty canker.	Slight	Slight	Slight	Moderate	Severe	Slight	Severe.
Pecan *Carya illinoinensis.*	Sunny sites; 50 to 60 feet high; 40 to 60 feet wide; dark green foliage; susceptible to root rot, aphids, and occasional gall.	Slight	Moderate	Moderate	Moderate	Severe	Moderate	Severe.
Chinese Pistache *Pistacia chinensis.*	Sunny sites; 40 to 50 feet high; 30 to 45 feet wide; green foliage, bronze in fall; occasional root rot.	Slight	Slight	Slight	Slight	Moderate	Slight	Severe.
Willow, weeping *Salix babylonica.*	Sunny sites; 40 to 50 feet high; 50 feet wide; light green foliage, yellow in fall; bark sun burns, susceptible to chlorosis; highly susceptible to nematodes.	Slight	Moderate	Moderate	Moderate	Severe	Moderate	Severe.
Desert Willow *Chilopsis linearis.*	Sunny sites; 15 to 20 feet high; 15 to 25 feet wide; light green foliage; purple flower spring to fall; susceptible to root rot.	Slight	Slight	Slight	Moderate	Moderate	Slight	Severe.
Sycamore *Platanus* sp.	Sunny sites; 40 to 50 feet high; 30 to 40 feet wide; bronze flower in fall; highly susceptible to chlorosis; leaf burn.	Slight	Moderate	Moderate	Slight	Severe	Moderate	Severe.
FLOWERING TREES (ROOT DEPTH 6 TO 8 FEET)								
Acacia, Bailey *Acacia baileyana.*	Sunny sites; 20 to 25 feet high; 20 to 40 feet wide; feathery, blue-gray foliage; yellow flower January to February; occational chlorosis.	Slight	Moderate	Moderate	Slight	Moderate	Moderate	Severe.
Bottlebrush *Callistemon* sp.	Sunny sites; 18 feet high; 10 feet wide; gray-green to purplish foliage; red flower April to June; highly susceptible to chlorosis.	Slight	Moderate	Moderate	Slight	Severe	Moderate	Severe.
Jacaranda *Jacaranda scutifolia.*	Sunny sites; 30 feet high; 15 to 30 feet wide; fernlike, light green foliage; lavender flower April to September; frost tender and occasional chlorosis.	Slight	Moderate	Moderate	Slight	Severe	Moderate	Severe.
Orchid Tree *Bauhinia variegata.*	Sunny sites; 15 feet high; 10 to 20 feet wide; light green foliage; white flower January to April; frost tender; salts sensitive.	Slight	Moderate	Moderate	Slight	Severe	Moderate	Severe.

See footnote at end of table.

TABLE 8.—*Tree and shrub planting guide*—Continued

FLOWERING TREES—Continued

Common and botanical names	Characteristics of plantings	Limitation of soils for plant growth[1]						
		Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7
Peach, flowering *Prunus persica* var.	Sunny sites; 15 feet high; 10 to 15 feet wide; green foliage; white flower in spring; susceptible to chlorosis, crown gall, and root rot.	Slight	Moderate	Moderate	Moderate	Severe	Moderate	Severe.
Plum, ornamental *Prunus* sp.	Sunny sites; 20 feet high; 10 to 15 feet wide; purple foliage; pink flower in spring; susceptible to chlorosis, crown gall, and root rot.	Slight	Slight	Moderate	Slight	Severe	Slight	Moderate.
Redbud *Cercis* sp.	Partially shady sites; 15 feet high; 10 to 18 feet wide; red or yellow foliage in fall; red flower in spring; salts sensitive.	Slight	Moderate	Moderate	Slight	Severe	Moderate	Severe.
Chaste Tree *Vitex* sp.	Sunny sites; 15 feet high; 15 to 20 feet wide; gray-green foliage; purple flower July to November.	Slight	Slight	Moderate	Slight	Moderate	Slight	Severe.
NATIVE TREES (ROOT DEPTH 3 TO 12 FEET)								
Ironwood *Olneya tesota.*	Sunny sites; 15 to 20 feet high; 10 to 20 feet wide; gray-green foliage; purple flower May to June; frost tender; sensitive to overwatering.	Slight	Moderate	Moderate	Slight	Severe	Moderate	Severe.
Mesquite, Screwbean *Prosopis pubescens.*	Sunny sites; 10 to 20 feet high; 10 to 25 feet wide; gray-green foliage; yellow flower May to August; root borers.	Slight	Slight	Slight	Slight	Moderate	Slight	Moderate.
Mesquite, Arizona *Prosopis juliflora.*	Sunny sites; 20 to 40 feet high; 25 to 50 feet wide; gray-green foliage; yellow flower April to June; root borers.	Slight	Slight	Slight	Slight	Moderate	Slight	Moderate.
Paloverde, Blue *Cercidium floridum.*	Sunny sites; 10 to 30 feet high; 15 to 40 feet wide; gray-green foliage; yellow flower March to April; root borers.	Slight	Slight	Slight	Slight	Severe	Slight	Moderate.
Paloverde, littleleaf *Cercidium microphyllum.*	Sunny sites; 10 to 25 feet high; 20 to 50 feet wide; gray-green foliage; yellow flower April to May; root borers.	Slight	Slight	Slight	Slight	Severe	Slight	Moderate.
Cypress, Arizona *Cupressus Arizonica.*	Sunny sites; 30 to 40 feet high; 15 to 30 feet wide; gray to green foliage; root rot and bark beetle.	Slight	Moderate	Moderate	Moderate	Severe	Moderate	Severe.
Lysiloma (featherbush) *Lysiloma thornberi.*	Sunny sites; 8 to 15 feet high; 12 to 18 feet wide; feathery green foliage; frost tender.	Slight	Moderate	Slight	Slight	Severe	Moderate	Severe.
Acacia, sweet *Acacia farnesiana.*	Sunny sites; 20 to 25 feet high; 15 to 25 feet wide; feathery gray foliage; yellow flower April to September; frost tender.	Slight	Moderate	Slight	Slight	Severe	Moderate	Severe.

See footnote at end of table.

TABLE 8.—*Tree and shrub planting guide*—Continued

FAN-TYPE PALMS (ROOT DEPTH 1 TO 4 FEET)

Common and botanical names	Characteristics of plantings	Limitation of soils for plant growth[1]						
		Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7
Palmetto *Sabal* sp.	Sunny sites; 6 to 80 feet high; 6 to 18 feet wide; greenfoliage; white flower.	Slight	Moderate	Moderate	Slight	Severe	Moderate	Severe.
Palm, California fan *Washingtonia filifera.*	Sunny sites; 10 to 60 feet high; 15 to 25 feet wide; green foliage; white flower; susceptible to bed rot and occasionally to nematodes.	Slight	Slight	Moderate	Slight	Moderate	Slight	Moderate.
Palm, Mexican fan *Washingtonia robusta.*	Sunny sites; 80 to 100 feet high; 15 to 25 feet wide; green foliage; white flower; susceptible to bed rot and occasionally to nematodes.	Slight	Slight	Moderate	Slight	Moderate	Slight	Severe.
Quadalupe palm	Sunny sites; 40 feet high; 6 to 8 feet wide; light green foliage; white flower.	Slight	Moderate	Moderate	Slight	Severe	Moderate	Severe.
Mexican blue palm.	Sunny sites; 40 feet high; 6 to 8 feet wide; silvery blue foliage; creamy white flower.	Slight	Moderate	Moderate	Slight	Severe	Moderate	Severe.
Mediterranean fan palm.	Sunny sites; 15 to 20 feet high; 5 to 15 feet wide; green foliage; white flower.	Slight	Moderate	Moderate	Slight	Severe	Moderate	Moderate.

PINNATE OR FEATHER PALMS (ROOT DEPTH 1 TO 3 FEET)

Pindo palm	Partially shady sites; 10 to 20 feet high; 10 to 25 feet wide; gray-green arching foliage; white flower; frost tender.	Slight	Moderate	Moderate	Slight	Severe	Moderate	Severe.
Queen palm	Sunny sites; 35 to 45 feet high; 15 to 30 feet wide; weeping light green foliage; white flower; frost tender; susceptible to chlorosis and bud rot.	Slight	Moderate	Moderate	Slight	Severe	Moderate	Severe.
Palm, Sago *Cycas revoluta.*	Partially shady sites; 8 to 15 feet high; 15 to 30 feet wide; light green foliage; white flower; semi-frost tender.	Slight	Slight	Moderate	Slight	Severe	Slight	Moderate.
Palm, Canary Island Date. *Phoenix canariensis.*	Sunny sites; 35 to 40 feet high; 30 feet wide; green foliage; white flower.	Slight	Slight	Moderate	Slight	Moderate	Slight	Moderate.
Palm, Date *Phoenix dactylifera.*	Sunny sites; 40 feet high; 30 feet wide; green foliage; white flower.	Slight	Slight	Moderate	Slight	Moderate	Slight	Moderate.
Pigmy Date Palm *Phoenix roebelenii.*	Sunny sites; 6 to 8 feet high; 6 to 10 feet wide; light green foliage; white flower; frost tender; susceptible to chlorosis.	Slight	Moderate	Moderate	Slight	Severe	Moderate	Moderate.

See footnote at end of table.

TABLE 8.—*Tree and shrub planting guide*—Continued

GROUND COVER (ROOT DEPTH 1 TO 3 FEET)

Common and botanical names	Characteristics of plantings	Limitation of soils for plant growth[1]						
		Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7
Fern Asparagus *Asparagus densiflorus* var. 'Springeri'	Partially to fully shady; ½ to 1 foot high; 1 to 3 feet wide; light green foliage; pink flower in spring; susceptible to chlorosis; semi-frost tender.	Slight	Moderate	Moderate	Slight	Severe	Moderate	Moderate.
Gazania *Gazania* sp.	Sunny sites; ½ to 1 foot high; 6 inches to 1 foot wide; green foliage; multicolored flower April to June.	Slight	Slight	Slight	Moderate	Severe	Slight	Moderate.
Ivy, Algerian *Hedera canariensis.*	Shady sites; ½ to 1 foot high; 6 to 12 feet wide; evergreen foliage; susceptible to root rot; sensitive to overwatering; scale.	Slight	Moderate	Moderate	Moderate	Severe	Moderate	Moderate.
Ivy, English *Hedera helix.*	Shady sites; ½ to 1 foot high; 6 to 12 feet wide; evergreen foliage; susceptible to occasional root rot.	Slight	Slight	Slight	Slight	Severe	Slight	Moderate.
Ice plant *Malephora* sp.	Partially shady to sunny; ⅛ to ½ inch high; 6 inches to 1 foot wide; gray to blue-green foliage; purple flower April to June; susceptible to nematodes and root rot.	Slight	Moderate	Moderate	Moderate	Severe	Moderate	Moderate.
Lippia *Phyla nodiflora.*	Sunny to semishady sites; ½ to 1 foot high; green foliage; lilac flower spring to fall; crown gall; nematodes.	Slight	Slight	Slight	Moderate	Moderate	Slight	Moderate.
Lantana *Lantana montevidensis.*	Sunny sites; ½ to 1 foot high; 3 to 6 feet wide; green foliage; lavender flower March to October; frost tender; nematodes.	Slight	Slight	Slight	Moderate	Moderate	Moderate	Moderate.
Honeysuckle, Hall's *Lonicera japonica* var. 'Halliana'.	Sunny sites; 1 to 1½ feet high; 4 to 8 feet wide; green foliage; yellow flower in spring; susceptible to chlorosis and root rot.	Slight	Moderate	Moderate	Moderate	Severe	Moderate	Moderate.
African Daisy, Trailing *Osteospermum fruticosum.*	Sunny sites; ½ to 1 foot high; 4 to 6 feet wide; green foliage; lilac flower November to March.	Slight	Slight	Moderate	Slight	Severe	Slight	Moderate.
Cinquefoil, Spring *Potentilla verna.*	Sunny or shady sites; ⅛ to ½ foot high; 6 inches to 1½ feet wide; light green foliage; yellow flower spring to summer; susceptible to root rot.	Slight	Slight	Moderate	Moderate	Moderate	Slight	Moderate.
Rosemary, Dwarf *Rosemarinus officinalis* var. 'Prostratus'.	Sunny sites; 2 feet high; 2 to 4 feet wide; gray-green foliage; lavender flower winter to spring; phytophthora; Texas root rot.	Slight	Slight	Moderate	Moderate	Moderate	Slight	Moderate.
Verbena *Verbena peruviana.*	Sunny sites; ½ to 1 foot high; 6 inches to 1½ feet wide; green foliage multicolored flower in summer; leaf hoppers and nematodes.	Slight	Slight	Slight	Moderate	Moderate	Slight	Moderate.

See footnote at end of table.

TABLE 8.—*Tree and shrub planting guide*—Continued

GROUND COVER—Continued

Common and botanical names	Characteristics of plantings	Limitation of soils for plant growth[1]						
		Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7
Periwinkle *Vinca major.*	Partially shady sites; ½ to 2 feet high; 3 to 6 feet wide; green foliage; lavender flower spring and summer; susceptible to chlorosis.	Slight-----	Moderate--	Moderate--	Slight-----	Moderate--	Moderate--	Moderate.
Star Jasmine *Trachelospermum jasminoides.*	Partially shady sites; ½ to 1 feet high; 3 to 6 feet wide; green foliage in spring; white flower in spring; nematodes, occasional root rot.	Slight-----	Slight-----	Moderate--	Moderate--	Moderate--	Slight-----	Moderate.
Lavender-cotton *Santolina chamaecyparissus*	Sunny sites; 1 to 2 feet high; 1 to 3 feet wide; gray foliage; yellow flower in summer; root rot.	Slight-----	Moderate--	Moderate--	Moderate--	Moderate--	Moderate--	Moderate.

[1] Slight—little modification of the site needed for growth of climatically adapted species.
Moderate—some modification of the site is necessary for growth of other than recommended plants.
Severe—extensive modification of the site is necessary to grow other than the recommended plants.

removed. Some soils are compacted by heavy equipment during construction, or they have a plowpan because they were farmed. These layers must be loosened. In some places deep excavations have been made and have not properly settled. Several deep irrigations are needed in these places. A tree well 2 to 4 inches deep around the plant can be used for irrigating.

The horticultural groups in Maricopa County, Central Part, are described in the paragraphs that follow.

HORTICULTURAL GROUP 1

Soils in this group are deep sandy loams to clay loams. They have no visible lime within a depth of 40 inches, and they are relatively free of salts and alkali. They have few limitations.

One inch of water in the tree well wets the soil to a depth of 5 to 9 inches. One inch of water applied in the tree well 6 to 12 times wets the soil to a depth of 5 feet. At field capacity, the water available is adequate to supply mature plants for about 20 to 25 days in summer and 25 to 30 days in winter. Nitrogen fertilizer should be applied in the irrigation water two or three times during the year.

HORTICULTURAL GROUP 2

Soils in this group are deep sandy loams to clay loams. They have concentrations of lime at a depth ranging from 14 to 30 inches and are relatively free of salts and alkali.

Plants susceptible to chlorosis tend to be chlorotic when they mature in these soils. Iron and phosphorus are tied up in the lower layers because the concentration of lime is high. Iron in the form of chelate should be sprayed on chlorotic plants as needed, and phosphorus should be worked into the soil as deeply as possible three or four times a year. Nitrogen should be applied in the irrigation water two to four times a year.

One inch of water applied in the tree well wets the soil to a depth of 6 to 9 inches. One inch of water applied in the tree well 6 to 12 times wets the soil to a depth of 5 feet. At field capacity, the water available is adequate to supply mature plants for about 12 to 18 days in summer and 18 to 25 days in winter.

HORTICULTURAL GROUP 3

Soils in this group are deep. They have a surface layer of loam to clay and clay lower layers. Water moves slowly downward through most of these soils. The soils are easily waterlogged. Some are more than 50 percent gravel. Some contain excessive amounts of saline or alkali salts or both. Others are relatively salt free.

Some alkali or saline-alkali soils in this group benefit from applications of soil amendments. Sulfur, for example, increases the infiltration rate of irrigation water and increases and aids in the removal of salts. Phosphorus is beneficial for some plants. It should be applied as deeply in the soil as possible. Nitrogen should be applied in the irrigation water two to four times during the year, depending on the type of plant growth.

One inch of water in the tree well wets the soil to a depth of 5 to 8 inches. One inch of water applied in the tree well 7 to 12 times a year wets the soil to a depth of 5 feet. At field capacity, the water available is adequate to supply mature plants for about 12 to 15 days in summer and 16 to 25 days in winter. These soils should not be overirrigated because waterlogging and lack of air make plants chlorotic.

HORTICULTURAL GROUP 4

Most soils in this group have a surface layer of loamy sand to clay loam and are underlain by sand at a depth of 12 to 34 inches. Some, however, have a surface layer of sandy loam that is underlain by very gravelly sand at a depth of about 5 inches. All the soils have limited

available water capacity. They are relatively free of salts and alkali and do not contain visible lime.

Nitrogen should be applied in the irrigation water five to six times a year. Phosphorus should be applied two or three times a year and mixed into the soil as deeply as possible. Mixing manure, straw, or peat moss with the soil improves water capacity.

One inch of water applied in the tree well four to eight times a year wets the soil to a depth of 5 feet. At field capacity, the water available is adequate to supply mature trees or shrubs for about 7 to 10 days in summer and 10 to 15 days in winter.

HORTICULTURAL GROUP 5

Soils in this group are deep sandy loams to clay loams. They contain excessive amounts of saline or alkali salts or both. Some contain visible lime at a depth of less than 12 inches.

Unless these soils are reclaimed, only salt-tolerant species grow. Soil amendments help in reclaiming the soil. They should be mixed as deeply as possible, and several deep leachings with water should follow. In some areas, several years are needed to reclaim the soil before any but salt-tolerant species succeed.

One inch of water applied in the tree well 6 to 12 times a year wets the soil to a depth of 5 feet. The water available at field capacity is adequate to supply mature plants for about 7 to 12 days in summer and 12 to 18 days in winter. Some water in these soils is not available to plants because the salt content is high. Overirrigation makes some of the soils waterlogged.

HORTICULTURAL GROUP 6

Soils in this group are deep. They have a surface layer of sandy loam to gravelly loam and lower layers of gravelly loam to very gravelly loam. All contain visible lime at a depth of 7 to 30 inches, but are relatively free of salts and alkali.

Mature plants that are susceptible to chlorosis tend to be chlorotic on these soils. Iron and phosphorus are tied up in the lower layers because the concentration of lime is high. Iron in the form of chelate should be sprayed on the chlorotic plants as needed, and small amounts of phosphorus should be mixed into the soils as deeply as possible four or five times a year. Nitrogen should be applied in the irrigation water three or four times a year. Manure or peat applications are beneficial if it is possible to work them into the soil.

One inch of water applied in the tree well three to four times wets some of these soils to a depth of 5 feet. At field capacity in these soils, the water available is adequate to supply mature plants about 5 to 7 days in the summer and 8 to 10 days in the winter. The other soils in this group require 1 inch of water applied in the tree well five to seven times to wet them to a depth of 5 feet. At field capacity, the water available is adequate to supply mature plants for about 7 to 12 days in summer and 12 to 18 days in winter.

HORTICULTURAL GROUP 7

Soils in this group are shallow to moderately deep. They are loams to clay loams underlain by a hardpan or bedrock at a depth ranging from 10 to 39 inches. Some of the soils are strongly alkaline and have the same needs as soils in horticultural group 5. Water moves through the soils at a moderate or slow rate, but is stopped by the hardpan. Roots cannot penetrate the hardpan or bedrock.

The hardpan can be broken up or removed by blasting or heavy equipment. Adding topsoil, however, is a more practical method of increasing rooting depth.

One inch of water applied to the tree well one to two times wets some of these soils. At field capacity in these soils, the water available is adequate to supply mature plants about 4 to 7 days in summer and 7 to 10 days in winter. The other soils in this group require 1 inch of water applied in the tree well three to eight times to wet them thoroughly. At field capacity in these soils, water available is adequate to supply mature plants for about 8 to 12 days in summer and 12 to 15 days in winter. Overirrigation waterlogs the soils and makes plants chlorotic.

The high content of lime causes iron chlorosis in mature, susceptible plants, and iron in the form of chelate is needed. Small amounts of phosphorus should be worked into the soils as deeply as possible two to three times a year. Nitrogen should be applied in the irrigation water four or five times during the year.

Formation and Classification of Soils

This section describes the factors that affect the formation of soils in Maricopa County, Central Part, and explains the major processes of soil formation. It also defines the current system of classification and classifies the soils according to that system.

Factors of Soil Formation

Soils differ according to differences in the factors that govern their formation. These factors are relief or topography, climate, organisms, parent material, and time. Regional differences in soils usually reflect differences in climate and vegetation, but local differences are more often caused by differences in topography, parent material, and time. The influence of each soil-forming factor on the soils of the survey area is summarized on the pages that follow.

Parent material

Parent material is the weathered rock or unconsolidated material in which soil forms. The hardness, grain size, and porosity of the parent material and its content of weatherable material greatly influence the formation of the soil. The two main sources of parent material in Maricopa County, Central Part, are alluvium and hard bedrock. Most of the soils are derived from alluvium, which, in turn, is derived from a variety of sources and from geologic materials of several different ages. Soils in the center of the intermontane valleys are generally very mixed and are derived from both local and distant sources. Most of the material has been transported into these areas by major streams, such as the Gila, Salt, Agua Fria, and Hassayampa Rivers. Smaller amounts of sediment are derived locally from tributaries of these streams that originate in the mountains nearby.

In general, there are two ages of surfaces in the area. Mohall, Tremant, Laveen, and Coolidge soils, for example, are on the older surfaces, and Avondale, Gilman, and Glenbar soils are on the younger surfaces. In some areas, soils of the older surface are being eroded and sediment is

deposited on the younger surface. In other areas, soils of the younger surface are being eroded and sediment is deposited on the older surface. Trix and Estrella soils formed in such areas. The parent material of the soils on both surfaces is essentially the same, mainly granite-gneiss, schist, andesite, rhyolite, granite, basalt, and limestone.

Material on the alluvial fans has been transported by ephemeral streams from the nearby mountains. Near the base of mountains are some very old surfaces on which Ebon, Pinamt, and Pinal soils formed. In some of these areas ephemeral streams are entrenched 10 to 20 feet, leaving stable surfaces and contributing minor amounts of sediment to the alluvial fans below. Mature soils, such as the Ebon and Pinamt soils, formed mainly at the base of the granite-gneiss mountains. Pinal soils, for example, are at the base of the granite-gneiss, basalt, welded tuff, schist, and andesite mountains. In many areas, these very old surfaces have been stripped away or buried and surfaces of a moderate age occur directly at the base of the mountain. Gunsight, Rillito, and Coolidge soils are on these surfaces, Immediately below are very young surfaces and the Antho and Carrizo soils. The parent material of all soils on alluvual fans reflects the mountains above and is dominantly granitic. In many areas, the very young alluvial fans are encroaching on older surfaces of the valley plain below. Valencia soils formed in this manner.

Soils on the mountains are forming in material weathered in place from hard bedrock, including granite-gneiss, basalt, granite, schist, welded tuff, andesite, and rhyolite.

Wind transported silt is a minor but important source of soil material for all soils in the area. This material is soon reworked by water and incorporated into alluvial deposit.

Climate

Climate is a very important factor in the soil-forming process in the Maricopa County, Central Part. The present climate is warm, arid, and semi-arid continental. Rainfall is low, and temperatures are high. Soil temperature readings indicate that the soils are in a hyperthermic family. Enough moisture is available for the weathering of minerals and the formation of silicate clays, but is not sufficient to rapidly move carbonates and clay into the subsoil. Climate in the past 10,000 years is believed to have been much more humid than the present (*2*). Many soils that have a B horizon, such as Mohall, Tucson, Ebon, Tremant, and Pinamt soils, are believed to have formed then. As the climate became drier, carbonates were leached less deeply, and many of the B horizons that were probably once free of lime are now calcareous within a few inches of the surface. Several of the more stable areas, such as those under a desert pavement, have a miniature profile in the upper 3 to 4 inches of the soil. This profile is in an ABC horizon sequence and may be the type of profile that is forming under the present climate.

Relief

Relief, or lay of the land, influences soil formation through its effect on moisture, temperature, and erosion. Most of the area is characterized by broad, featureless valleys that range from 750 to 1,350 feet in elevation and are bounded by north-oriented mountain ranges 900 to 3,700 feet high. The four general landforms in the area are the mountains and low hills, the alluvial fans at the base of mountains, the valley plains in the center of valleys, and the low stream terraces and flood plains that are in or adjacent to major stream channels of the area.

Erosion has been very active. The mountains and some alluvial fans are steep and are the most active. Antho and Carrizo soils do not have well-defined horizons because they are on gently sloping alluvial fans that receive deposition during every major storm. Shape of the slope is also important. Convex-shaped slopes are more subject to erosion, produce more runoff, and are less deeply leached of lime than flatter slopes. Rillito, Gunsight, and Perryville soils are on alluvial fans that have a convex surface. Vecont and Beardsley soils are in concave swales that receive additional moisture and sediment during major storms. As a result of air drainage, air temperatures in winter are about 5° warmer on the alluvial fans than on the lower valley plains.

Aspect has had little effect on soil formation in this area except for a few mountain ranges. Soils on some mountains are slightly deeper on the north-and east-facing slopes because rainfall is more effective, temperatures are cooler, plants are more numerous, and some silts are wind deposited there.

Organisms

The effect of plants, animals, and men is important in soil formation.

The hot, dry climate of the area inhibits plant growth, and the organic-matter content of most soils is only 0.1 to 0.5 percent before irrigation. The high temperature and lack of moisture favor rapid oxidation and destroy organic matter as fast as it accumulates. The kind of plants that grow in a particular place depend on the microrelief and the moisture available. Scattered mesquite, paloverde, and ironwood trees are along narrow drainageways. Creosotebush and cactus grow on the drier sites. The root systems of these plants provide little organic matter. Grass grows in swales where runoff concentrates and the content of organic matter is somewhat higher, but seldom is more than 0.5 percent.

Rodents and reptiles are important soil-forming factors. In some areas they have physically mixed the soil and destroyed soil horizons. In others they bring lime to the surface, which inhibits formation of soil horizons.

Man has had a strong influence on soil formation. Vast populations of plants grew in irrigated areas where previously the plant cover had been sparse. The content of organic matter increased to about 1 percent, or in a few soils to nearly 1.5 percent. Bacterial activity increased greatly. Some soils received large applications of manure. Some that had previously had large concentrations of salt were reclaimed or partly reclaimed. Some that were relatively free of salts received additions of salts from low-quality irrigation water. Nearly all soils in the area have been leveled to some degree. The surface and occasionally the subsoil of some soils have been removed and deposited on other soils. Muddy irrigation water has deposited large amounts of silt, clay, and organic matter over large areas. The surface layer of these soils is now clay or clay loam and is more than 1 percent organic matter. Accelerated erosion in some desert areas has resulted from overgrazing, roadbuilding, and the diversion of stream channels.

Time

Soils of the area range from very young to very old. The kind of horizon and the degree of profile formation depend in part on how long the surface has remained stable, or how long the soil-forming processes have been active.

Soils in stream channels, flood plains, and low stream channels are very young. They receive fresh sediment during periodic flooding, and well-defined horizons have not had time to form. Some organic matter has accumulated to form an A1 horizon, but no further differentiation of horizons has taken place. Before irrigation, the soil profile is noneffervescent to slightly effervescent. No filaments of lime and no lime coatings on coarse fragments occur. Brios, Vint, and Carrizo soils are examples. They are probably no more than a few hundred years old.

Soils on valley plains are of several ages. Gilman, Antho, and Glenbar, which are some of the younger soils, occasionally receive additions of sediment and have not had time for well-defined horizons to form. A few filaments of lime are in the lower layers. These soils probably range from a few hundred to about 1,000 years in age. Also on valley plains are soils that have well-formed profiles, such as Mohall, Tremant, Tucson, and Laveen soils. Mohall, Tremant, and Tucson soils have a B horizon that is weak to moderate in structure. They are underlain by a well-defined calcic horizon that has few to common lime concretions. Laveen soils have a well-defined calcic horizon and common to many lime concretions. The age of these soils ranges from about 7,000 years to late Pleistocene.

Soils on alluvial fans are of three general ages. At the base of some mountains are remnants of some very old surfaces where Ebon, Pinamt, and Pinal soils formed. Ebon and Pinamt soils have a well-defined textural and structural B horizon and are fairly well leached of lime. Pinal soils have a well-defined duripan that has a laminar layer over a plugged horizon. Soils on this surface date to mid-Pleistocene. Below this surface are Rillito, Gunsight, and Perryville soils. They have a well-defined calcic horizon and few to many lime concretions. They probably range from 7,000 years to late Pleistocene in age. Antho and Carrizo soils are at the lower ends of alluvial fans and are in or adjacent to ephemeral streams. They receive periodic additions of sediment from flooding and have not had time to form well-defined horizons. They have a few filaments of lime in the lower horizons. They range from a few hundred years to about 800 years in age.

Classification

Soils are classified so that we can more easily remember significant characteristics. Classification enables us to assemble knowledge about the soils, to see their relationship to one another and to the whole environment, and to develop principles that help us to understand their behavior and their response to manipulation. First through classification, and then through use of soil maps, we can apply our knowledge of soils to specific fields and other tracts of land.

The narrow categories of classification, such as those used in detailed soil surveys, allow us to organize and apply knowledge about soils in managing farms, fields, and woodlands; in developing rural areas; in engineering work; and in many other ways. Soils are placed in broad classes to facilitate study and comparison in large areas, such as countries and continents.

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965. Because this system is under continual study, readers interested in developments of the current system should search the latest literature available (*4, 6*).

The current system of classification has six categories. Beginning with the broadest, these categories are order, suborder, great group, subgroup, family, and series. In this system the differentiae used as a basis for classification are soil properties that can be observed in the field, or that can be inferred from observable field soil properties or from combined data of soil science and other disciplines. The properties selected for the higher categories are the result of soil genesis or affect soil genesis. In table 9 the soil series of Maricopa County, Central Part, are classified according to the current system. Classes of the current system are defined briefly in the following paragraphs.

ORDER.—Ten soil orders are recognized. The differentiae for the orders are based on the kind and degree of the dominant sets of soil-forming processes that have been active. Each order is named with a word of three or four syllables ending in *sol* (Ent-i-sol).

SUBORDER.—Each order is divided into suborders that are based primarily on properties that influence soil genesis and that are important to plant growth or were selected to reflect what seemed to be the most important variables within the orders. The names of suborders have two syllables. The last syllable indicates the order. An example is *Argid* (*Arg*, modified from Argillic horizon, and *id*, from Aridisol).

GREAT GROUP.—Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of expression of pedogenic horizons, soil moisture, and temperature regimes and in base status. The names of great groups consist of the name of the suborder and a prefix that suggests something about the properties of the soil. An example is Haplargid (*Hapl*, meaning simple horizons, *arg*, modified from Argillic horizon, and *id*, from Aridisols).

SUBGROUP.—Each great group is divided into subgroups, one representing the central (typic) segment of the group, and others called intergrades that have properties of the group and also one or more properties of another great group, suborder, or order. Subgroups may also be made in those instances where soil properties intergrade outside of the range of any other great group, suborder, or order. The names of subgroups are derived by placing one or more adjectives before the name of the great group. An example is Typic Haplargids (a typical Haplargid).

FAMILY.—Soil families are established within a subgroup primarily on the basis of properties important to the growth of plants or on the behavior of soils when used for engineering. Among the properties considered are texture, mineral composition, reaction, soil temperature, permeability, thickness of horizons, and consistence. A family name consists of a series of adjectives preceding the subgroup name. The adjectives are the class names for texture and mineralogy, for example, that are used as

TABLE 9.—*Soil series classified according to the current system of classification* [1]

Series	Family	Subgroup	Order
Agualt	Coarse-loamy over sandy or sandy-skeletal, mixed, (calcareous), hyperthermic.	Typic Torrifluvents	Entisols.
Antho	Coarse-loamy, mixed, (calcareous), hyperthermic	Typic Torrifluvents	Entisols.
Avonda	Fine-loamy over sandy or sandy-skeletal, mixed, (calcareous), hyperthermic.	Typic Torrifluvents	Entisols.
Avondale	Fine-loamy, mixed, (calcareous), hyperthermic	Typic Torrifluvents	Entisols.
Beardsley	Fine, mixed, hyperthermic	Typic Durargids	Aridisols.
Brios	Sandy, mixed, hyperthermic	Typic Torrifluvents	Entisols.
Carrizo	Sandy-skeletal, mixed, hyperthermic	Typic Torriorthents	Entisols.
Casa Grande	Fine-loamy, mixed, hyperthermic	Typic Natargids	Aridisols.
Cashion	Clayey over loamy, mixed, hyperthermic	Typic Torrifluvents	Entisols.
Cherioni	Loamy-skeletal, mixed, hyperthermic	Typic Durorthids	Aridisols.
Coolidge	Coarse-loamy, mixed, hyperthermic	Typic Calciorthids	Aridisols.
Ebon	Clayey-skeletal, mixed, hyperthermic	Typic Haplargids	Aridisols.
Estrella	Fine-loamy, mixed, (calcareous), hyperthermic	Typic Torrifluvents	Entisols.
Gachado	Loamy-skeletal, mixed, hyperthermic	Lithic Haplargids	Aridisols.
Gadsden	Fine, montmorillonitic, (calcareous), hyperthermic	Vertic Torrifluvents	Entisols.
Gilman	Coarse-loamy, mixed, (calcareous), hyperthermic	Typic Torrifluvents	Entisols.
Glenbar	Fine-silty, mixed, (calcareous), hyperthermic	Typic Torrifluvents	Entisols.
Gunsight	Loamy-skeletal, mixed, hyperthermic	Typic Calciorthids	Aridisols.
Harqua	Fine-loamy, mixed, hyperthermic	Typic Haplargids	Aridisols.
La Palma	Fine-loamy, mixed, hyperthermic	Typic Durargids	Aridisols.
Laveen	Coarse-loamy, mixed, hyperthermic	Typic Calciorthids	Aridisols.
Maripo	Coarse-loamy over sandy or sandy-skeletal, mixed, (calcareous), hyperthermic.	Typic Torrifluvents	Entisols.
Mohall	Fine-loamy, mixed, hyperthermic	Typic Haplargids	Aridisols.
Perryville	Coarse-loamy, carbonatic, hyperthermic	Typic Calciorthids	Aridisols.
Pinal	Coarse-loamy, mixed, hyperthermic	Typic Durorthids	Aridisols.
Pinamt	Loamy-skeletal, mixed, hyperthermic	Typic Haplargids	Aridisols.
Rillito	Coarse-loamy, mixed, hyperthermic	Typic Calciorthids	Aridisols.
Suncity	Fine-loamy, mixed, hyperthermic	Typic Durargids	Aridisols.
Toltec	Coarse-loamy, mixed, hyperthermic	Entic Durorthids	Aridisols.
Tremant	Fine-loamy, mixed, hyperthermic	Typic Haplargids	Aridisols.
Trix	Fine-loamy, mixed, (calcareous), hyperthermic	Typic Torrifluvents	Entisols.
Tucson	Fine-loamy, mixed, hyperthermic	Typic Haplargids	Aridisols.
Valencia	Coarse-loamy, mixed, (calcareous), hyperthermic	Typic Torrifluvents	Entisols.
Vecont	Fine, mixed, hyperthermic	Typic Haplargids	Aridisols.
Vint	Sandy, mixed, hyperthermic	Typic Torrifluvents	Entisols.
Wintersburg	Fine-loamy, mixed, hyperthermic	Typic Calciorthids	Aridisols.

[1] Placement of some soil series in the current system of classification, particularly in families, can change as more precise information becomes available. Soils classified as of March 1973.

family differentiae. An example is the fine-loamy, mixed, hyperthermic family of Typic Haplargids.

Two soil orders are represented in the survey area—Aridisols and Entisols.

Aridisols in this area probably formed in a moister and cooler climate than that of the present. No water is available in any part of the moisture-control section more than 50 percent of the year. Aridisols have a light-colored surface layer that is less than 1 percent organic matter. Two suborders, argids and orthids, are in the Aridisol order.

Argids have an argillic or a natric horizon, and in places have a calcic horizon or a duripan. The argids in the survey area are classified in three great groups—Durargids, Natrargids, and Haplargids.

Durargids have a duripan below the argillic horizon. Beardsley soils are examples. All soils in this great group are in a typic suborder.

Natrargids have a natric horizon that generally is more than 15 percent exchangeable sodium. Casa Grande soils are examples. All soils in this great group are in a typic suborder.

Haplargids have an argillic horizon and lack a duripan or a natric horizon. They generally have a calcic horizon. Mohall soils are examples. Except for Gachado soils, all soils of this great group are in a typic suborder. Gachado soils are underlain by bedrock at a depth of less than 50 centimeters and are classified as Lithic Haplargids.

Orthids in this area have no argillic or natric horizon, but have a calcic horizon or a duripan within a depth of 1 meter. Two great groups of orthids, Durorthids and Calciorthids, are in the survey area.

Durorthids have a platy or massive duripan within a depth of 1 meter and lack a cambic horizon. Pinal soils are Typic Durorthids that have an indurated duripan. Toltec soils are Entic Durorthids that have a weakly cemented to strongly cemented duripan. Calciorthids have a calcic horizon within a depth of 1 meter and are calcareous above the calcic horizon after the upper 18 centimeters are mixed. They have no duripan within a depth of 1 meter. All soils in this great group are in a typic subgroup.

Entisols in this area are too young to have diagnostic horizons. They have a light-colored surface layer that is

less than 1 percent organic matter. They are on valley plains, alluvial fans, stream terraces, and flood plains that receive periodic depositions of fresh alluvium. Two suborders of Entisols, Orthents and Fluvents, are in the survey area.

Orthents have an organic-carbon content that decreases with increasing depth and is less than 0.2 percent within a depth of 1.25 meters. Only one great group, Torriorthents, is classified in this suborder. These soils have no water available in any part of the moisture-control section more than 50 percent of the time when the soil temperature at a depth of 50 centimeters is more than 5° C. Carrizo soils are examples of a Typic Torriorthent.

Fluvents have an organic-carbon content that decreases irregularly with increasing depth. Only one great group, Torrifluvents, is classified in this suborder. These soils have no water available in the moisture-control section more than 50 percent of the time when the soil temperature at a depth of 50 centimeters is more than 5° C. All but Gadsden soils are in a typic suborder. Gilman and Estrella soils are examples. Gilman soils have no diagnostic horizon within a depth of 1 meter. Estrella soils have an argillic horizon within a depth of 1 meter, but it is a buried horizon. Gadsden soils are classified as Vertic Torrifluvents. They are clayey and unless irrigated, have deep cracks that remain open for more than 240 days during the year.

Laboratory Analyses

Results of the physical and chemical analyses of soils are shown in table 10. Data for Perryville and La Palma soils were taken from the site location for the series described in the section "Descriptions of the Soils." Data for the remaining soils, although not based on the representative profile, represent the physical and chemical properties typical of the series. Each profile was sampled in two or more areas, but the results were similar and data are given for only one profile. The methods of analyses are described in the following paragraphs:

Sample preparation. All samples were air dried and the clods were broken up with a wooden rolling pin and screened through a 2-millimeter round-holed sieve. Coarse fragments larger than 2 millimeters were weighed to determine the gravel content and then discarded.

Size class and diameter of particles. Organic matter was destroyed by hydrogen peroxide and the sample was dispersed with sodium metaphosphate. The sand fraction was separated from the silt and clay by screening through a 300-mesh sieve. The sand fraction was further screened through a nest of sieves to determine individual sand fractions. Silt and clay were determined by the pipette method.

Reaction. Soil reaction, expressed in pH value, was measured with a glass electrode pH meter at a 1:10 water ratio and as a saturated paste.

Cation exchange capacity. The sample was saturated and leached with an ammonium acetate solution. Water, granular zinc, and 1N NaOH were added to the sample and distilled into a 4 percent boric acid solution. The solution was then titrated with hydrochloric acid.

Extractable cations. The sample was saturated and leached with ammonium acetate. The leachate was analyzed for calcium and magnesium by atomic adsorption. Potassium and sodium were analyzed by flame photometry.

Exchangeable sodium. The percentage of exchangeable sodium, or the degree of saturation of the exchange complex with sodium, is a value derived by dividing the exchangeable sodium by the cation exchange capacity (NH_4O Ac) and multiplying the result by 100.

Electrical conductivity. An extract was drawn from a saturated paste. Conductivity of the saturation extract was determined by a conductivity bridge and conductivity cell. Readings were converted to mmhos/cm after correcting to 25° C using a standard table.

Organic carbon. The percent of organic carbon was determined by acid dichromate digestion and ferrous sulfate titration.

Carbonate as $CaCO_3$. Calcium carbonate was determined by measurement of CO_2 gas given off from the acidification of samples with HCl.

Bulk density oven dry. Values were obtained by collecting natural clods and dipping them in a solution of saran resin that had been dissolved in methyl ethyl ketone and measuring the displacement when a saran-coated clod was dipped in water. Corrections were made for coarse fragments greater than 2 millimeters.

Water content, ⅓ bar. The determination was made using a pressure plate on natural clods coated with saran.

Water content, 15 bar. The determination was made using a pressure membrane extraction on sieved samples.

Additional Facts About the Area

In this section the physiography, relief, and drainage of the survey area are described and a brief history of the irrigation and water supply is given. The farming of the area is described, and harvested acreages of the principal crops are listed. The section also includes a report on the climate of the survey area.

Physiography, Relief, and Drainage

Maricopa County, Central Part, is characterized by broad, featureless valleys between north-oriented mountain ranges. Elevations range from 750 to 1,350 feet in the valleys and from 900 to 3,700 feet in the mountains. All the valleys have a southward gradient except Rainbow Valley, which has a northward gradient.

Drainage of the Salt River Valley mainly is provided by the Gila River and its Agua Fria and Salt River tributaries. Drainage of the Rainbow Valley mainly is Waterman Wash, which also flows into the Gila River. Harquahala Valley is drained by Centennial Wash. Except for a few areas between Buckeye and Gillespie Dam, the entire survey area is well drained. The water table in most areas is below a depth of 200 feet and dropping.

The four general landforms in the area are valley plains; stream channels, flood plains, and low terraces; alluvial fans; and mountains and low hills. The valley plains appear to be level, but rise steadily with increasing steepness from the axial trough toward the marginal mountains. Slope is less than 1 percent near the axial trough and approaches 9 or 10 percent near the mountains.

Stream channels, flood plains, and low terraces are the lowest points on the landscape. They are in or adjacent to the major stream channels. Valley plains and the rem-

TABLE 10.—*Physical and chemical*

[A dashed line or no entry

Soil	Horizon	Depth	Size class and diameter of particles [1]							
			Very coarse sand (2.0–1.0 mm)	Coarse sand (1.0–0.5 mm)	Medium sand (0.5–0.25 mm)	Fine sand (0.25–0.10 mm)	Very fine sand (0.10–0.5 mm)	Silt (0.5–0.002 mm)	Clay (less than 0.002 mm)	Gravel [2] (2–76 mm)
		cm	*Pct*	*Pct*	*Pct*	*Pct*	*Pct*	*Pct*	*Pct*	*Pct*
Casa Grande fine sandy loam	A1	0–7	5.6	10.7	10.5	20.5	22.1	26.0	4.6	1
	B21tca	7–16	4.0	7.1	7.1	14.4	17.0	35.3	15.1	2
	B22tca	16–36	3.3	7.1	8.0	14.4	15.7	29.8	21.7	2
	B31tca	36–65	3.1	9.8	10.1	13.0	13.1	27.2	23.7	2
	B32tca	65–92	1.1	5.4	7.7	13.9	18.3	36.3	17.3	
	C1ca	92–130	1.9	6.0	7.6	13.2	18.3	38.1	14.9	3
	C2	130–165	.7	4.8	12.4	33.0	16.9	24.1	8.1	1
Gilman loam	Ap	0–36	5.2	6.5	5.6	14.4	20.9	36.8	10.6	4
	C1	36–51	5.8	5.3	4.8	14.6	21.4	37.9	10.3	3
	C2	51–71	1.3	2.3	4.1	18.3	23.0	43.6	7.4	1
	C3	71–91	1.4	1.9	2.5	10.8	23.3	52.8	7.3	
	C4	91–109	1.5	2.7	4.3	16.6	26.3	41.0	7.6	1
	C5	109–127								2
	C6	127–152								1
Harqua gravelly loam	A2	0–2.5	3.4	4.2	2.8	7.7	18.0	50.5	13.4	9
	A&B	2.5–8	6.7	6.1	3.2	7.1	16.5	43.0	17.5	30
	B2tsa	8–23	7.9	7.9	3.3	5.4	12.4	26.1	37.0	32
	B31tcasa	23–38	18.7	10.2	3.8	6.7	16.1	19.2	25.3	35
	B32tcasa	38–48	15.6	11.2	5.0	9.8	21.1	20.5	16.8	43
	B33tcasa	48–76	6.0	6.5	3.0	5.1	20.4	37.5	21.5	7
	C1casa	76–99	7.6	7.6	4.0	6.5	22.1	31.5	20.5	12
	C2casa	99–122	12.3	12.1	5.7	7.3	24.8	23.8	14.1	18
	IIC3casa	122–152	34.0	28.6	7.3	4.1	3.9	9.2	13.0	59
	IIIC4sa	152–178								47
La Palma very fine sandy loam	A11	0–4	.3	.9	1.1	9.6	27.9	53.6	6.6	
	A12	4–12	.2	.6	1.0	9.3	29.8	53.0	6.1	
	B1t	12–19	.1	.6	.8	8.9	26.5	56.6	6.5	
	B2tca	19–29	.5	.9	1.0	7.8	21.1	48.4	20.3	
	B3tca	29–46	.7	.9	1.4	6.0	16.0	43.6	31.4	
	C1ca	46–68	18.2	7.8	3.4	6.5	9.6	33.1	21.4	
	C2sicam	68–73								
Laveen loam	Ap1	0–15	5.1	9.5	7.3	13.4	17.0	35.3	12.4	8
	Ap2	15–38	5.2	9.0	7.3	12.8	18.6	34.4	12.7	9
	C1	38–61	8.3	8.0	5.4	9.5	14.0	37.2	17.6	18
	C2ca	61–96	6.5	6.7	4.6	8.7	13.9	39.5	20.2	12
	C3ca	96–127	7.8	5.7	3.6	6.6	9.6	46.9	19.8	30
	C4ca	127–213								15
	C5	213–249								1
Perryville gravelly loam	Ap	0–23	5.4	7.3	4.4	9.7	15.8	39.9	17.5	20
	C1ca	23–41	7.2	5.8	3.4	7.2	12.7	43.8	19.9	35
	C2ca	41–69	7.6	6.6	4.0	7.5	11.3	45.0	18.1	43
	C3ca	69–96	5.8	8.3	4.8	8.5	11.9	45.1	15.6	24
	C4ca	96–142								5
	C5ca	142–165								4
	IIC6ca	165–183								55

[1] Based on percent of soil less than 2 millimeters in diameter.
[2] Approximate values.

nants of a few old stream terraces are at slightly higher elevations. They roughly parallel but are one-fourth to one-half mile from the major stream channels. Near the base of mountains are alluvial fans. They are generally at right angles to the valley plains. They are generally distinct where the ephemeral stream leaves the mountain, but lose their identity downslope where they coalesce, forming a single broad plain. Often the alluvial fan surface is a complex pattern of old and young alluvium. The areas of old alluvium appear stable because the ephemeral

analysis of representative soils

indicates no data is available]

Reaction		Cation exchange capacity (NH_4OAc)	Extractable cations (meq per 100 g of soil)				Exchangeable sodium	Electrical conductivity [2]	Organic carbon	Carbonate as $CaCO_3$	Bulk density oven dry	Water content		Coefficient of linear extensibility
Saturated paste	In 1:10 soil water suspension		Calcium	Magnesium	Potassium	Sodium						⅓ Bar	15 Bar	
pH	*pH*	*meq per 100 g*					*Pct*	*mmhos per cm at 25° C*	*Pct*	*Pct*	*g/cc*	*Pct*	*Pct*	
		7.2	9.7	1.9	1.0	0.6	8	0.42	0.12	[4] T	1.70	8.8	3.1	0.002
8.3	10.0	18.3	16.9	2.7	1.6	9.3	48	2.25	.14	6	1.63	17.7	7.3	.017
8.4	10.2	18.0	13.9	1.9	.8	16.5	77	6.2	.01	8	1.76	15.9	9.0	.025
8.1	9.5	14.0	18.8	1.7	.5	17.6	60	16.9		7	1.62	19.2	8.8	.040
8.3	9.9	10.6	13.8	1.3	.4	15.6	74	16.9		10			7.6	
8.7	10.1	8.4	12.2	1.4	.3	12.9	77	13.8		17	1.69	16.2	6.5	.020
8.8	10.1	6.6	11.7	1.2	.2	8.7	75	9.8		5	1.77	8.6	3.9	.015
7.6	8.8	11.3			1.8	.7	4	3.48	.42	T	1.70	14.3	4.9	.008
7.8	9.1	10.9			1.0	.5	5	.38	.19	1	1.61	13.7	5.9	.008
8.1	9.2	9.5			.6	.6	6	.28		2	1.48	15.5	5.6	.007
8.1	9.3	10.1			.5	.8	8	.35		2			6.1	
8.1	9.4	9.5			.4	.8	8	.43		2			4.7	
8.0								.40			1.44	18.4	7.4	.017
8.0								.60					5.2	
8.4	9.9	20.5			4.6	1.7	21	1.26	07	7	1.57	17.7	9.0	.012
8.5	9.8	21.8			6.8	1.7	27	3.95		4	1.53	16.1	10.7	.011
7.7	8.6	17.8			14.8	1.2	21	36.9		4	1.37	21.7	12.9	.025
7.5	8.4	12.1			12.8	.7	13	33.5		4	1.58	15.2	9.3	.008
7.7	8.6	8.7			9.5	.4	31	35.7		2	1.60	12.4	6.6	.006
7.6	8.6	10.1			11.1	.4	8	36.4		12	1.51	21.7	8.4	.029
7.7	8.6	8.5			9.8	.4	12	31.6		14	1.60	18.2	7.6	.035
8.0	8.8	10.1			7.2	.2	8	19.8		10	1.63	14.2	5.6	.015
		8.5								10	1.62	12.3	5.5	.006
8.0		6.1			8.5	.3	33	19.0		5	1.56	14.6	5.7	.004
		9.9	14.2	3.3	1.3	.4	4	.69	.61	4	1.32	13.6	5.3	.010
		9.5	12.6	3.6	1.6	.6	6	.49	.37	5	1.45	12.1	4.7	.007
8.6	9.9	9.9	10.3	3.6	2.8	3.5	29	2.37	.38	5	1.59	16.1	5.0	.006
8.6	10.2	13.2	10.3	3.3	3.4	10.5	60	6.2	.26	16	1.59	17.8	8.8	.022
9.3	10.1	17.6	10.9	2.4	3.5	19.0	82	10.0	.07	27	1.66	24.2	11.5	.051
9.4	10.2	10.9	8.8	2.4	2.3	13.0	81	10.7		54	1.79	19.0	9.1	.038
9.4	10.2	4.6	10.3	2.5	1.1	5.7	91	6.6		79	2.06	5.3	3.1	
7.6	8.7	8.5			1.6	2.0	6	4.50	.59	8	1.45	19.4	6.2	.002
7.9	9.0	8.7			.7	.9	8	.70	.35	8	1.54	18.2	7.0	.008
7.9	9.2	8.3			.8	.9	10	.90		16	1.64	16.5	8.3	.007
7.9	9.1	8.1			1.0	1.0	7	1.68		20			9.2	
8.0	9.1	6.2			.8	.6	13	.80		39	1.42	20.7	8.4	.016
8.3	9.3	6.4			.9	.5	11	.50		32			9.5	
8.4	9.5	11.0			1.5	.6	14	.40		31			9.7	
7.9	9.0	9.0			.5	.4	2	1.14	.21	19	1.32	26.8	7.9	.009
8.1	9.2	6.8			.5	.9	13	.55		33	1.14	36.3	8.8	.015
7.9	9.2	7.3			.3	.7	10	.70		36	.93	51.7	8.8	.018
7.8	9.1	7.8			.3	.8	10	.72		34	.89	60.6	9.1	.014
										36	1.61	20.0	8.8	.010
										24	1.58	20.4	8.1	.008
										10	1.49	17.4	5.9	.003

[3] Based on whole soil.
[4] Trace.

streams in these areas have become deeply entrenched. The recent alluvium can occur at the foot of an older entrenched fan. In places the alluvial fans are encroaching on the valley plains. Some extend several miles from mountain fronts.

Some places in the survey area could have been old playas. One is near Luke Air Force Base, and the other is in the southern part of the Harquahala Valley. Both areas now have through-flowing drainage. The area near Luke Air Force Base is underlain by a silica-lime cemented

hardpan. The area in the southern part of the Harquahala Valley is underlain by a highly mottled, highly stratified sediment, and the nearby hills show evidence of having been an old shoreline.

History of Irrigation and Water Supply

The white man was not the first to dig canals and irrigate the fields in Maricopa County, Central Part. Centuries before the first white settlers came, Indians farmed the area. These Indians, given the name "Hohokam," settled on the banks of the Gila River about 300 years before the birth of Christ. They depended upon periodic flooding to irrigate the fields. Around 700 to 900 A.D., the population shifted from the Gila to the Salt River, and for centuries that civilization flourished. Miles of canals were dug and some 22 villages were constructed in the Salt River Valley. It is estimated that as much as 96,000 acres was under cultivation.

The Indians grew a variety of crops, including corn, beans, melons, squash, and cotton. This civilization flourished for several hundred years before the Indians returned to the Gila River. The reason they left the Salt River is not clear, but historians have suggested that it may have been the salts that built up in the soil, the waterlogged fields, the climatic change, or the continuing threat of raids by other Indians. By 1400 A.D. the Salt River Valley was completely abandoned.

Irrigation by white settlers began about 1867. Crude diversion dams were constructed, and the first canal was completed in 1869. Barley, corn, sweet potatoes, and pumpkins were among the first crops. The project expanded rapidly. In 1892, about 121,000 acres was cultivated in the Salt River Valley. Then a severe drought struck the area. Streamflow was erratic, ranging from small streams to enormous floods. The water flow at low stage was inadequate for cultivation, and the flow in excess of immediate needs was lost because storage facilities were not available. In 1902, Congress passed the Reclamation Act and built Roosevelt Dam, which created storage and regulation of the Salt River. The dam was completed in 1911. The Horse Mesa, Mormon Flat, and Stewart Mountain Dams were built between 1922 and 1930, and Bartlett Dam on the Verde River by 1939. In 1927, the Maricopa County Water Conservation District No. 1 built a dam on the Agua Fria River that impounded water behind Waddel Dam. This irrigation district serves about 33,000 acres east of the White Tank Mountains.

By the early 1920's, drainage was a serious problem in the Salt River Valley, and the Roosevelt Irrigation District was formed in 1923. Drainage wells were established in the area near Tolleson to remove excess ground water and transport it out of the project boundary. A flume was constructed across the Agua Fria River, and canals were dug to convey water into the Roosevelt Irrigation District boundaries. The eastern boundary of this district, about 17 miles west of the center of Phoenix, is about 21 miles long from east to west and 3 miles long from north to south.

The Buckeye Canal dates back to 1885 (*3*). Originally it diverted water from the Gila River at a point just west of the confluence of the Gila and Agua Fria Rivers. The irrigation district is about 2 miles wide and extends west from the town of Avondale to near the Hassayampa River. The total cultivated acreage is about 18,500. Water is obtained from deep pumps and the Gila River and through a water right from the Salt River Project. These sources are supplemented by tail water from farms above and sewage effluent from the city of Phoenix.

Other irrigation districts in the survey area are New States, Arlington, and St. Johns. Some of them had water rights to surface water, but surrendered them to other irrigation districts for rights to tail water or water from deep wells.

The Harquahala and Rainbow Valleys and the area near Tonopah and Wintersburg have been cultivated for only a short time. These areas depend on deep wells for irrigation water. The annual pumpage of irrigation water from the Harquahala Valley increased from 33,000 acre feet in 1954 to about 200,000 acre feet in 1963 (*8*). Increasing withdrawal of ground water caused the water level to decline as much as 200 feet from 1954 to 1963. An increased rate of decline is expected as the water table is lowered.

Farming [7]

The kind of crops grown in Maricopa County, Central Part, has changed little since early times, but farming has changed radically. Early farms were highly diversified, almost completely self-sustaining units 80 to 160 acres in size. The main crops were cotton, alfalfa, and small grain. A small garden and orchard produced fruit and vegetables for the family. Most farmers kept beef and dairy cattle, pigs, chickens, and turkeys for their own use.

The size of farms ranges from 320 to 10,000 acres. The main cash crop generally is cotton. Alfalfa and small grain are grown to improve fertility, tilth, and organic-matter content. The acreage in dairy farms is no more than is needed for corrals and milking parlors. Most of the feed is bought off the farm. Poultry farmers cage chickens. The main acreage of vegetable crops is restricted to a few farmers who specialize in such crops. Citrus groves generally require large acreages. Only a few farmers have the small groves characteristic of many early farms.

Cotton is the main cash crop for farmers who do not specialize. The new, shorter varieties that mature earlier are planted two rows to the bed in April and May and are harvested early in September. The crop is picked with a stripper. No irrigation is needed after the first part of August. Yields are slightly lower than those of older varieties, but net profit is about the same because operating costs are lower. Cotton is subject to several plant diseases and insect pests. Plant diseases are controlled by rotating crops or by soil treatment. Insect pests are controlled by spraying or dusting.

Alfalfa is planted in borders late in fall or early in spring. Fall planting is preferred because returns are more immediate. Six to eight cuttings a year are obtained. The hay is harvested as bales, cubes, or chopped green and fed directly to cattle. Alfalfa lasts from 3 to 5 years before it is crowded out by weeds and grasses.

Wheat and barley are planted in borders or furrows late in fall or early in winter. Harvest is late in May or June.

Sorghum grain is planted following a wheat or barley crop in a double-cropping program. Planting date is usually late in June through July. Early maturing varieties are

[7] By MARVIN SKOUSEN, soil conservationist, Soil Conservation Service, Buckeye, Arizona.

planted late in July. Sorghum is planted in furrows and grown for both ensilage and grain. Ensilage is cut before November 1 or the first killing frost. Sorghum for grain is harvested after November 1 or when the moisture content of the soil is less than about 13 percent.

Safflower is planted from about December 15 to January 15 and harvested in July or August.

Sugar beets for both sugar and seed are planted from about August 15 to September 15 and harvested from June to July. Maricopa County formerly produced about 75 percent of the sugar beet seed for the United States. Plant disease, however, and an increase of sugar beets grown for sugar have significantly reduced production of sugar beets grown for seed.

Vegetables have two general seasons. Vegetables planted late in August are ready for harvest in winter. Vegetables planted in November or early in December are ready for harvest in spring. Vegetables grown in the survey area are lettuce, carrots, onions, cabbage, cauliflower, broccoli, turnips, spinach, radishes, brussel sprouts, and table beets.

Several varieties of cantaloup and watermelons are grown. Melons ready for market by late June or early in July are planted early in spring or late in winter. Melons are not grown in the same field more than once every 5 to 6 years because of soil-born diseases.

The tillage needed for border crops follows:

1. Shred or chop crop residue from previous crop.
2. Disc field.
3. Plow.
4. Drag or float field in opposite direction of plowing.
5. Build borders.
6. Either side drag between borders or put in checks next to borders.
7. Irrigate.
8. Disc lightly and plant. (Some crops are planted before irrigation).

The tillage needed for furrow crops follows:

1. Shred or chop crop residue from previous crop.
2. Disc field.
3. Plow.
4. Drag or float field in opposite direction of plowing.
5. Furrow out.
6. Irrigate.
7. Mulch seedbed and plant. (Some crops are planted before irrigation).

The following tabulation indicates the estimated harvested acreage in 1972 of the principal crops in Maricopa County, according to the Arizona Crop and Livestock Reporting Service:

	Acres
Cotton	94,000
Long staple	18,000
Short staple	76,000
Alfalfa	94,000
Barley	64,000
Wheat	56,000
Sorghum and corn	43,000
Safflower	12,750
Sugar beets (sugar and seed)	7,016
Vegetables	37,830
Cantaloups	1,340
Honeydew melons	70
Watermelons	2,000
Potatoes	11,580
Irish	11,080
Sweet	500
Lettuce	15,050
Spring	8,150
Fall	6,900
Carrots	2,935
Spring	2,035
Fall	900
Cauliflower	615
Broccoli	1,000
Cabbage	1,200
Onions	2,040
Dry	1,040
Green	1,000
Citrus	16,750
Navel and sweet	3,700
Valencia	4,600
Grapefruit	5,000
Lemon	2,000
Tangerine	500
Tangelos	500
Other citrus	450
Grapes	3,980
Thompson seedless	2,570
Cardinals	740
Exotics	380
Purlettes	275
Robins	15
Apricots	200

Climate [8]

Maricopa County has a desert-type climate. Relative humidity and annual rainfall are low. Table 11 gives climatic data representative of the survey area. Table 12 gives probable dates of freezing temperatures in spring and fall.

Daytime temperatures throughout the summer are normally high, but winters are generally mild. Nighttime temperatures frequently drop below freezing during the three coldest months, but afternoons are commonly sunny and mild. The average daytime relative humidity, based on observation at 11 a.m. and 5 p.m. at Phoenix Airport, is about 30 percent.

Temperatures are normally high in summer. From early June until mid-September the afternoon maximum temperature commonly exceeds 100° F., and temperatures of 110° or more are not uncommon. According to records kept at Phoenix Airport, about 83 days per year have a maximum temperature of 100° or higher. The average date in spring of the first occurrence of at least 100° is May 17. The average date in fall of the last occurrence of at least 100° is September 26. Phoenix Airport normally has 7 days per year when the maximum temperature is at least 110°. The greatest number of such days was 27 in 1936.

[8] Prepared by PAUL C. KANGEISER, State climatologist, National Weather Service, U.S. Dept. of Commerce.

TABLE 11.—*Temperature and precipitation*

[Data recorded at Buckeye for period 1941 to 1970. Elevation 870 feet]

Month	Temperature				Precipitation				
	Average daily maximum	Average daily minimum	Two years in 10 will have at least 4 days with—		Average monthly total	One year in 10 will have—		Days with snow cover	Average depth of snow on days with snow cover
			Maximum temperature equal to or higher than—	Minimum temperature equal to or less than–		Less than—	More than—		
	°F	°F	°F	°F	Inches	Inches	Inches	Number	Inches
January	67	34	77	25	0.7	[1] T	1.6	[2]	T
February	72	38	83	28	.7	T	1.7	[2]	T
March	77	42	89	33	.7	T	1.8	0	0
April	85	48	99	39	.3	0	.9	0	0
May	95	55	107	46	.1	0	.3	0	0
June	103	63	114	54	.1	0	.2	0	0
July	107	74	114	65	.8	T	1.7	0	0
August	105	73	112	64	1.3	.1	2.7	0	0
September	101	65	110	55	.7	0	2.3	0	0
October	90	52	100	42	.4	0	1.0	0	0
November	77	41	88	32	.5	T	1.2	0	0
December	68	35	79	27	.8	T	2.2	[2]	T
Year	87	52	[3] 116	[4] 23	7.1	3.8	10.8	[2]	T

[1] Trace.
[2] Less than 0.5 day.
[3] Average annual highest temperature.
[4] Average annual lowest temperature.

TABLE 12.—*Probabilities of last freezing temperatures in spring and first in fall*

[Data recorded at Buckeye for period 1935 to 1964. Elevation 870 feet]

Probability	Dates for given probability and temperature			
	20° F or lower	24° F or lower	28° F or lower	32° F or lower
Spring:				
1 year in 10 later than	January 17	February 17	March 17	March 31.
2 years in 10 later than		February 8	March 7	March 24.
5 years in 10 later than		January 18	February 13	March 10.
Fall:				
1 year in 10 earlier than	December 28	November 26	November 11	October 31.
2 years in 10 earlier than		December 5	November 18	November 5.
5 years in 10 earlier than		December 26	December 3	November 17.

Late in spring and early in summer, when the air is dry, the temperature normally varies by 40° or more between early afternoon and daybreak, and evenings are moderately cool. In July and August, however, higher relative humidity sometimes holds minimum temperatures above 80°. In winter, minimum temperatures fall to 32° or lower on an average of 29 days in Tempe, and on 44 days in Buckeye.

There are two separate precipitation seasons. The first occurs from November to March, when the area is subjected to occasional storms from the Pacific Ocean. Winter precipitation is greatest when the middle latitude storm track is unusually far south, so that storms enter Arizona directly from the west or southwest after picking up considerable moisture from the Pacific Ocean. In such cases, cloudy skies and intermittent showers can prevail for several days. In winter when the storm track is somewhat north of its normal position, the area generally has little precipitation, a pattern that can last into spring. An example is the period from December 30, 1971 through June 6, 1972 (a period of 160 consecutive days) when no measurable precipitation was reported at Phoenix Airport. Snowfall is rare in the valleys in this section of Arizona. An occasional light fall occurs in the mountains above the 2,500-foot level.

The second rainfall season occurs in July, August, and most of September, when the area experiences widespread thunderstorm activity associated with moist air moving into Arizona from the southern quadrant. The time of maximum probability of occurrence of these storms is from about 8 p.m. to midnight. These thunderstorms are extremely variable in intensity and location, and some of the heaviest amounts of precipitation observed in a short period occur during these months. In some years,

unusually heavy precipitation can occur near the end of summer when a tropical disturbance moves northward from the Pacific Ocean. These storms affect the weather in the State about once in 7 years, and on such occasions the area can receive a normal summer's rainfall in less than 1 day. Estimated return periods for excessive precipitation computed for Phoenix show that 2.66 inches of precipitation will fall during a 1-hour period about once in 100 years, 2.97 inches in 3 hours, 3.35 inches in 6 hours, 3.69 inches in 12 hours, and 4.04 inches in 24 hours.

The mean windspeed at Phoenix Airport is about 6 miles per hour. Velocities of 70 and 80 miles per hour are recorded at intervals of 50 and 100 years.

According to records kept at Phoenix from 1896 to 1971, the annual average percentage of the possible sunshine is 86 percent. The minimum monthly average is 77 percent in December, and the maximum is 94 percent in June. The greatest number of consecutive days with 100 percent of possible sunshine was 28, from June 12 through July 9, 1928. The greatest number of days with zero percent of possible sunshine at the same station was three, from November 22 through November 24, 1965.

Lake evaporation averages about 72 inches per year. The maximum is in summer, and the minimum in winter.

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Glossary

Alkali soil. Generally, a highly alkaline soil. Specifically, an alkali soil has so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that the growth of most crop plants is low from this cause.

Alluvial fan. A fan-shaped deposit of sand, gravel, and fine material dropped by a stream where its gradient lessens abruptly.

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern.

Available water capacity (also termed available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.

Calcareous soil. A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of clay on the surface of a soil aggregate. Synonyms: clay coat, clay skin.

Coarse fragments. Mineral or rock particles more than 2 millimeters in diameter.

Cobble. A rounded or partly rounded fragment of rock, 3 to 10 inches in diameter.

Complex, soil. A mapping unit consisting of different kinds of soils that occur in such small individual areas or in such an intricate pattern that they cannot be shown separately on a publishable soil map.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard and brittle; little affected by moistening.

Dendritic. Pattern of stream channels, irregular branching in all directions, with tributaries joining main channels at all angles.

Depth, soil. The following classes of soil depth over bedrock or an indurated hardpan are used in this survey:

Inches	
0 to 20	Shallow.
20 to 40	Moderately deep.
More than 40	Deep.

Desert pavement. A layer of gravel or stone, on the ground surface, that remains after the fine particles are removed by wind or water.

Drainage class (natural). Refers to the conditions of frequency and duration of periods of saturation or partial saturation that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven different classes of natural soil drainage are recognized.

Excessively drained soils are commonly very porous and rapidly permeable and have a low available water capacity.

Somewhat excessively drained soils are also very permeable and are free from mottling throughout their profile.

Well-drained soils are nearly free from mottling and are commonly of intermediate texture.

Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A and upper B horizons and mottling in the lower B and the C horizons.

Somewhat poorly drained soils are wet for significant periods but not all the time, and some soils commonly have mottling at a depth below 6 to 16 inches.

Poorly drained soils are wet for long periods and are light gray and generally mottled from the surface downward, although mottling may be absent or nearly so in some soils.

Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

Duripan. See Hardpan.

Erosion. The wearing away of the land surface by wind (sandblast), running water, and other geological agents.

Fallow. Cropland left idle in order to restore productivity, mainly through accumulation of water, nutrients, or both. Summer fallow is a common stage before cereal grain in regions of limited rainfall. The soil is tilled for at least one growing season to

control weeds, to aid decomposition of plant residues, and to encourage the storage of moisture for the succeeding grain crop.

Fertility, soil. The quality of a soil that enables it to provide compounds, in adequate amounts and in proper balance, for the growth of specified plants, when other growth factors, such as light, moisture, temperature, and the physical condition of the soil, are favorable.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the oven-dry weight, after the gravitational, or free, water has been allowed to drain away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Flood plain. Nearly level land, consisting of stream sediments, that borders a stream and is subject to flooding unless protected artificially.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material may be sandy or clayey, and it may be cemented by iron oxide, silica, calcium carbonate, or other substance.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon.—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to relatively level plots surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops, or in orchards, to confine the flow of water to one direction.

Furrow.—Water is applied in small ditches made by cultivation implements used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Irrigation water, released at high points, flows onto the field without controlled distribution.

Leaching. The removal of soluble materials from soils or other material by percolating water.

Lime. Chemically, lime is calcium oxide (CaO), but its meaning has been extended to include all limestone derived materials applied to neutralize acid soils. Agricultural lime can be obtained as ground limestone, hydrated lime, or burned lime, with or without magnesium minerals. Basic slag, oystershells, and marl also contain calcium.

Lime concretion. An irregularly shaped, cemented segregation of lime which has formed from solution around a central nucleus.

Lime masses, soft. Uncemented, nearly pure segregations of lime having both width and depth.

Lime nodule. See lime concretion.

Microrelief. Minor surface configurations of the land.

Mottling, soil. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominant.* The size measurements are these: *fine,* less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium,* ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse,* more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Munsell notation. A system for designating color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with a hue of 10YR, a value of 6, and a chroma of 4.

Parent material. Disintegrated and partly weathered rock from which soil has formed.

Ped. An individual natural soil aggregate, such as a crumb, a prism, or a block, in contrast to a clod.

Permeability. The quality that enables the soil to transmit water or air. Terms used to describe permeability are as follows: *very slow, slow, moderately slow, moderate, moderately rapid, rapid,* and *very rapid.*

pH. See Reaction, soil.

Plowpan. A compacted layer formed in the soil immediately below the plowed layer.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH		*pH*
Extremely acid	Below 4.5	Neutral	6.6 to 7.3
Very strongly acid	4.5 to 5.0	Mildly alkaline	7.4 to 7.8
Strongly acid	5.1 to 5.5	Moderately alkaline	7.9 to 8.4
Medium acid	5.6 to 6.0	Strongly alkaline	8.5 to 9.0
Slightly acid	6.1 to 6.5	Very strongly alkaline	9.1 and higher.

Root zone. The part of the soil that is penetrated, or can be penetrated, by plant roots.

Runoff. Surface drainage of rainfall or melted snow.

Saline soil. A soil that contains soluble salts in amounts that impair growth of plants but that does not contain excess exchangeable sodium.

Sand. Individual rock or mineral fragments in a soil that range in diameter from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Slope. The following slope classes are used in this survey:

Percent	
0 to 3	Nearly level.
3 to 6	Gently sloping.
6 to 12	Sloping.
12 to 20	Moderately steep.
20 to 30	Steep.
More than 30	Very steep.

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular.*

Structureless soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Tillage of a soil below normal depth ordinarily to shatter a hardpan or claypan.

Substratum. Technically, the part of the soil below the solum.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

Tail water. That portion of the irrigation water that reaches the end of the field.

Terrace (geological). An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Tillage pan. See Plowpan.

Tilth, soil. The condition of the soil in relation to the growth of plants, especially soil structure. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable, granular structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Topsoil. A presumed fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Valley plain. Broad, nearly level, featureless flood plain produced by the filling of a valley floor.

Waterlogged. Saturated with water. Soil condition where a high or perched water table is detrimental to plant growth, resulting from overirrigation, seepage, or inadequate drainage; the replacement of most of the soil air by water.

Water table. The highest part of the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read both the description of the mapping unit and that of the soil series to which the mapping unit belongs. Capability units for irrigated soils are described on pages 59 to 62. Capability subclasses for dryland soils are described on pages 62 and 63. Range sites are described on pages 66 and 67. Other information is given in tables as follows:

Acreage and extent, table 1, page 8.
Estimated yields, table 2, page 63.
Engineering, tables 5 and 6, pages 72 through 85.
Recreation, table 7, page 88.

Map symbol	Mapping unit	Page	Capability unit and subclass Irrigated	Capability unit and subclass Dryland	Range site	Horticultural group	Wildlife habitat group Irrigated	Page	Wildlife habitat group Dryland	Page
			Symbol	Symbol	Name	Number				
Aa	Agualt loam	9	IIs-7	VIIs	Loam Upland	4	2	69	10	70
AbA	Antho sandy loam, 0 to 1 percent slopes	10	IIs-4	VIIs	Loam Upland	1	2	69	11	70
AbB	Antho sandy loam, 1 to 3 percent slopes	10	IIe-4	VIIe	Loam Upland	1	2	69	11	70
Ac	Antho sandy loam, saline-alkali	10	IIs-9	VIIs	Saline Upland	5	2	69	13	71
AdA	Antho gravelly sandy loam, 0 to 1 percent slopes	10	IIs-4	VIIs	Loam Upland	1	2	69	11	70
AdB	Antho gravelly sandy loam, 1 to 3 percent slopes	12	IIe-4	VIIe	Loam Upland	1	2	69	11	70
Ae	Antho-Brios sandy loams	12	IIIs-7	VIIs	----------	---	---	--	--	--
	Antho soil	--	------	------	Loam Upland	1	2	69	11	70
	Brios soil	--	------	------	Sandy Bottom	1	4	69	11	70
AfA	Antho-Carrizo complex, 0 to 1 percent slopes	12	IVs-7	VIIs	----------	---	---	--	--	--
	Antho soil	--	------	------	Loam Upland	1	2	69	11	70
	Carrizo soil	--	------	------	Sandy Bottom	4	6	70	12	71
AfB	Antho-Carrizo complex, 1 to 3 percent slopes	12	------	VIIe	----------	---	---	--	--	--
	Antho soil	--	------	------	Loam Upland	1	---	--	11	70
	Carrizo soil	--	------	------	Sandy Bottom	4	---	--	12	71
AGB	Antho-Carrizo complex, 0 to 3 percent slopes	12	------	VIIe	----------	---	---	--	--	--
	Antho soil	--	------	------	Loam Upland	1	---	--	11	70
	Carrizo soil	--	------	------	Sandy Bottom	4	---	--	12	71
AHC	Antho-Tremant complex, 1 to 5 percent slopes	13	------	VIIe	Loam Upland	---	---	--	11	70
	Antho soil	--	------	------	----------	1	---	--	--	--
	Tremant soil	--	------	------	----------	2	---	--	--	--
AkB	Antho-Tremant-Mohall complex, 1 to 5 percent slopes	13	------	VIIe	Loam Upland	---	---	--	11	70
	Antho soil	--	------	------	----------	1	---	--	--	--
	Tremant soil	--	------	------	----------	2	---	--	--	--
	Mohall soil	--	------	------	----------	2	---	--	--	--
AL	Antho association	13	------	VIIs	Loam Upland	1	---	--	11	70
AM	Antho-Valencia association	13	------	------	Loam Upland	1	---	--	11	70
	Antho soil	--	------	VIIs	----------	---	---	--	--	--
	Valencia soil	--	------	VIIc	----------	---	---	--	--	--
An	Avonda clay loam	14	IIs-7	VIIs	Sandy Bottom	4	1	68	11	70
Ao	Avondale clay loam	15	I-1	VIIc	Sandy Bottom	1	1	68	11	70
Ap	Avondale clay loam, saline-alkali	15	IIs-9	VIIs	Sandy Bottom	5	1	68	11	70
BE	Beardsley loam	15	------	VIIs	Clay Bottom	7	---	--	9	70
Br	Brios loamy sand	16	IVs-7	VIIs	Sandy Bottom	4	6	70	11	70
Bs	Brios sandy loam	16	IIIs-7	VIIs	Sandy Bottom	4	4	69	11	70
Bt	Brios loam	16	IIIs-7	VIIs	Sandy Bottom	4	4	69	11	70
CA2	Calciorthids and Torriorthents, eroded	16	------	VIIe	Loam Upland	6	---	--	12	71
Cb	Carrizo gravelly sandy loam	17	VIs-7	VIIs	Sandy Bottom	4	6	70	12	71

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Page	Capability unit and subclass Irrigated	Capability unit and subclass Dryland	Range site	Horticultural group	Wildlife habitat group Irrigated	Irrigated Page	Wildlife habitat group Dryland	Dryland Page
CeD	Carrizo-Ebon complex, 3 to 12 percent slopes	17	------	VIIe	----------	---	---	--	--	--
	Carrizo soil	--	------	------	Sandy Bottom	4	---	--	12	71
	Ebon soil	--	------	------	Clay Upland	3	---	--	11	70
CF	Carrizo and Brios soils	18	------	VIIs	Sandy Bottom	4	---	--	--	--
	Carrizo soil	--	------	------	----------	---	---	--	12	71
	Brios soil	--	------	------	----------	---	---	--	11	70
Cg	Casa Grande sandy loam	19	IIIs-9	VIIs	Saline Upland	5	5	69	14	71
Ch	Casa Grande loam	19	IIIs-9	VIIs	Saline Upland	5	5	69	14	71
Ck	Casa Grande complex	19	------	VIIs	Saline Upland	5	---	--	14	71
Cm	Casa Grande-Laveen complex, alkali	19	IIIs-9	VIIs	Saline Upland	5	5	69	14	71
Cn	Cashion clay, saline-alkali	20	IVs-9	VIIs	Sandy Bottom	3	8	70	11	70
CO	Cherioni-Rock outcrop complex	21	------	VIIe	Loam Hills	7	---	--	12	71
Cp	Coolidge sandy loam	21	IIs-7	VIIs	Loam Upland	2	2	69	11	70
CrB	Coolidge gravelly sandy loam, 1 to 3 percent slopes	22	IIe-7	VIIe	Loam Upland	2	2	69	11	70
Cs	Coolidge-Tremant complex	22	IIs-6	VIIs	Loam Upland	2	2	69	11	70
CV	Coolidge-Laveen association, 0 to 3 percent slopes	22	------	------	Loam Upland	2	---	--	11	70
	Coolidge soil	--	------	VIIs	----------	---	---	--	--	--
	Laveen soil	--	------	VIIc	----------	---	---	--	--	--
Dn	Dune land	22	------	VIIs	Loam Upland	4	---	--	12	71
EbD	Ebon gravelly loam, 0 to 8 percent slopes	23	------	VIIe	Clay Upland	3	---	--	11	70
EPD	Ebon-Pinamt complex, 0 to 10 percent slopes	23	------	VIIe	Clay Upland	---	---	--	11	70
	Ebon soil	--	------	------	----------	3	---	--	--	--
	Pinamt soil	--	------	------	----------	2	---	--	--	--
Es	Estrella loam	25	I-1	VIIc	Loam Upland	1	1	68	11	70
Et	Estrella loam, saline-alkali	25	IIs-9	VIIs	Saline Upland	5	1	68	11	70
GA	Gachado-Rock outcrop complex	25	------	VIIe	Loam Hills	7	---	--	12	71
Gb	Gadsden clay loam	26	IIIs-8	VIIs	Sandy Bottom	3	3	69	9	70
Gc	Gadsden clay	26	IIIs-3	VIIs	Sandy Bottom	3	3	69	9	70
Gd	Gadsden clay, saline-alkali	26	IVs-9	VIIs	Sandy Bottom	3	8	70	11	70
Ge	Gilman fine sandy loam	27	I-2	VIIc	Loam Upland	1	1	68	11	70
Gf	Gilman fine sandy loam, saline-alkali	27	IIs-9	VIIs	Saline Upland	5	1	68	11	70
GgA	Gilman loam, 0 to 1 percent slopes	28	I-1	VIIc	Loam Upland	1	1	68	11	70
GgB	Gilman loam, 1 to 3 percent slopes	28	IIe-1	VIIe	Loam Upland	1	1	68	11	70
Gh	Gilman loam, saline-alkali	28	IIs-9	VIIs	Saline Upland	5	1	68	11	70
GL	Gilman complex, saline-alkali	28	------	VIIs	Saline Upland	5	---	--	11	70
GM	Gilman-Antho association	28	------	------	Loam Upland	1	---	--	11	70
	Gilman soil	--	------	VIIc	----------	---	---	--	--	--
	Antho soil	--	------	VIIs	----------	---	---	--	--	--
GN	Gilman-Laveen association	28	------	VIIc	Loam Upland	---	---	--	11	70
	Gilman soil	--	------	------	----------	1	---	--	--	--
	Laveen soil	--	------	------	----------	2	---	--	--	--
Go3	Gilman, Antho and Glenbar soils, severely eroded	29	------	VIIe	Saline Upland	5	---	--	11	70
Gp	Gilman loam, clayey subsoil variant, moderately saline	29	IIIs-9	VIIs	Sandy Bottom	5	3	69	13	71
Gr	Glenbar loam	30	I-1	VIIc	Loam Upland	1	1	68	11	70
Gs	Glenbar loam, saline-alkali	30	IIs-9	VIIs	Saline Upland	5	1	68	13	71
Gt	Glenbar clay loam	30	I-1	VIIc	Loam Upland	1	1	68	11	70
Gu	Glenbar clay loam, saline-alkali	31	IIs-9	VIIs	Saline Upland	5	1	68	13	71
Gv	Glenbar clay	31	IIIs-3	VIIs	Loam Upland	1	3	69	11	70

Map symbol	Mapping unit	Page	Capability unit and subclass Irrigated	Capability unit and subclass Dryland	Range site	Horticultural group	Wildlife habitat group Irrigated	Page	Wildlife habitat group Dryland	Page
GWD	Gunsight-Pinal complex, 1 to 10 percent slopes	32	------	VIIe	Loam Upland	---	---	--	11	70
	Gunsight soil	--	------	------	------------	6	---	--	--	--
	Pinal soil	--	------	------	------------	7	---	--	--	--
GxA	Gunsight-Rillito complex, 0 to 1 percent slopes	32	IVs-7	VIIs	Loam Upland	6	7	70	11	70
GxB	Gunsight-Rillito complex, 1 to 3 percent slopes	32	------	VIIe	Loam Upland	6	---	--	11	70
GYD	Gunsight-Rillito complex, 0 to 10 percent slopes	33	------	VIIe	Loam Upland	6	---	--	11	70
HAB	Harqua complex, 0 to 3 percent slopes	34	------	VIIe	Saline Upland	5	---	--	14	71
HAC	Harqua complex, 3 to 8 percent slopes	34	------	VIIe	Saline Upland	5	---	--	14	71
HLC	Harqua-Gunsight complex, 0 to 5 percent slopes	34	------	VIIe	------------	---	---	--	--	--
	Harqua soil	--	------	------	Saline Upland	5	---	--	14	71
	Gunsight soil	--	------	------	Loam Upland	6	---	--	11	70
HM	Harqua-Laveen complex	35	------	VIIs	------------	---	---	--	--	--
	Harqua soil	--	------	------	Saline Upland	5	---	--	14	71
	Laveen soil	--	------	------	Loam Upland	2	---	--	11	70
HrB	Harqua-Rillito complex, 1 to 3 percent slopes	35	------	VIIe	------------	---	---	--	--	--
	Harqua soil	--	------	------	Saline Upland	5	---	--	14	71
	Rillito soil	--	------	------	Loam Upland	6	---	--	11	70
La	La Palma very fine sandy loam	36	IIIs-9	VIIs	Saline Upland	7	5	69	14	71
Lb	Laveen sandy loam	37	I-2	VIIc	Loam Upland	2	1	68	11	70
LcA	Laveen loam, 0 to 1 percent slopes	37	I-1	VIIc	Loam Upland	2	1	68	11	70
LcB	Laveen loam, 1 to 3 percent slopes	37	IIe-1	VIIe	Loam Upland	2	1	68	11	70
Ld	Laveen loam, saline-alkali	37	IIs-9	VIIs	Saline Upland	5	1	68	13	71
Le	Laveen clay loam	37	I-1	VIIc	Loam Upland	2	1	68	11	70
Lf	Laveen-Antho complex, saline-alkali	37	IIs-9	VIIs	------------	---	1	68	--	--
	Laveen fine sandy loam, saline-alkali	--	------	------	Saline Upland	5	---	--	13	71
	Laveen sandy loam	--	------	------	Loam Upland	2	---	--	11	70
	Antho sandy loam, saline-alkali	--	------	------	Saline Upland	5	---	--	13	71
	Antho sandy loam, 0 to 1 percent slopes	--	------	------	Loam Upland	1	---	--	11	70
Ma	Maripo sandy loam	38	IIIs-7	VIIs	Loam Upland	4	4	69	11	70
Mo	Mohall sandy loam	39	I-2	VIIc	Loam Upland	2	1	68	11	70
Mp	Mohall loam	39	I-1	VIIc	Loam Upland	2	1	68	11	70
Mr	Mohall clay loam	39	I-1	VIIc	Loam Upland	2	1	68	11	70
Ms	Mohall clay	39	IIIs-3	VIIs	Loam Upland	2	3	69	11	70
MTB	Mohall-Tremant complex, 0 to 3 percent slopes	39	------	VIIs	Loam Upland	2	---	--	11	70
MV	Mohall-Laveen association	40	------	VIIc	Loam Upland	2	---	--	11	70
Pa	Perryville sandy loam	41	IIs-7	VIIs	Loam Upland	6	1	68	11	70
Pb	Perryville loam, saline-alkali	41	IIIs-9	VIIs	Saline Upland	5	5	69	14	71
PeA	Perryville gravelly loam, 0 to 1 percent slopes	41	IIs-7	VIIs	Loam Upland	6	1	68	11	70
PeB	Perryville gravelly loam, 1 to 3 percent slopes	41	IIe-7	VIIe	Loam Upland	6	1	68	11	70
PRB	Perryville-Rillito complex, 0 to 3 percent slopes	41	------	VIIs	Loam Upland	6	---	--	11	70
PsA	Pinal loam, 0 to 1 percent slopes	42	IVs-5	VIIs	Loam Upland	7	7	70	11	70
PsB	Pinal loam, 1 to 3 percent slopes	42	------	VIIe	Loam Upland	7	---	--	11	70
PT	Pinal gravelly loam	42	------	VIIs	Loam Upland	7	---	--	11	70

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Page	Capability unit and subclass Irrigated	Capability unit and subclass Dryland	Range site	Horticultural group	Wildlife habitat group Irrigated	Irrigated Page	Wildlife habitat group Dryland	Dryland Page
PvB	Pinal-La Palma loams, 1 to 3 percent slopes	42	------	VIIe	----------	---	---	--	--	--
	Pinal soil	--	------	------	Loam Upland	7	---	--	11	70
	La Palma soil	--	------	------	Saline Upland	5	---	--	14	71
PWB	Pinal-Suncity complex, 0 to 3 percent slopes	43	------	VIIs	Loam Upland	7	---	--	11	70
PYD	Pinamt-Tremant complex, 1 to 10 percent slopes	43	------	VIIe	----------	2	---	--	11	70
	Pinamt soil	--	------	------	Clay Upland	---	---	--	--	--
	Tremant soil	--	------	------	Loam Upland	---	---	--	--	--
RaA	Rillito sandy loam, 0 to 1 percent slopes	44	IIs-6	VIIs	Loam Upland	6	2	69	11	70
RaB	Rillito sandy loam, 1 to 3 percent slopes	45	IIe-6	VIIe	Loam Upland	6	2	69	11	70
RbA	Rillito loam, 0 to 1 percent slopes	45	IIs-6	VIIs	Loam Upland	6	2	69	11	70
RbB	Rillito loam, 1 to 3 percent slopes	45	IIe-6	VIIe	Loam Upland	6	2	69	11	70
RhB	Rillito-Harqua complex, 1 to 3 percent slopes	45	------	VIIe	----------	---	---	--	--	--
	Rillito soil	--	------	------	Loam Upland	6	---	--	11	70
	Harqua soil	--	------	------	Saline Upland	5	---	--	14	71
RpE	Rillito-Perryville complex, 5 to 20 percent slopes	45	------	VIIe	Loam Upland	6	---	--	11	70
RS	Rock outcrop-Cherioni complex	46	------	------	----------	---	---	--	--	--
	Rock outcrop	--	------	VIII	----------	---	---	--	--	--
	Cherioni soil	--	------	VIIe	Loam Hills	7	---	--	12	71
Ta	Toltec loam	48	IIs-7	VIIs	Loam Upland	7	1	68	11	70
TB	Torrifluvents	48	------	VIIe	Loam Upland	4	4	69	11	70
Tc	Torriorthents	48	------	VIIs	----------	---	---	--	--	--
TD	Torripsamments and Torrifluvents, frequently flooded	48	------	VIII	----------	4	---	--	--	--
Te	Tremant loam	49	IIs-7	VIIs	Loam Upland	2	1	68	11	70
TfA	Tremant gravelly loam, 0 to 1 percent slopes	49	IIs-6	VIIs	Loam Upland	2	1	68	11	70
TfB	Tremant gravelly loam, 1 to 3 percent slopes	49	IIe-6	VIIe	Loam Upland	2	1	68	11	70
Tg	Tremant clay loam	49	IIs-7	VIIs	Loam Upland	2	1	68	11	70
Th	Tremant gravelly clay loam	50	IIs-6	VIIs	Loam Upland	2	1	68	11	70
TPB	Tremant complex, 0 to 3 percent slopes	50	------	VIIs	Loam Upland	2	---	--	11	70
TrA	Tremant-Rillito complex, 0 to 1 percent slopes	50	IIs-6	VIIs	Loam Upland	---	---	--	11	70
	Tremant soil	--	------	------	----------	2	1	68	--	--
	Rillito soil	--	------	------	----------	6	2	69	--	--
TrB	Tremant-Rillito complex, 1 to 3 percent slopes	50	------	VIIe	Loam Upland	---	---	--	11	70
	Tremant soil	--	------	------	----------	2	1	68	--	--
	Rillito soil	--	------	------	----------	6	2	69	--	--
TSC	Tremant-Rillito complex, 0 to 5 percent slopes	51	------	VIIs	Loam Upland	---	---	--	11	70
	Tremant soil	--	------	------	----------	2	---	--	--	--
	Rillito soil	--	------	------	----------	6	---	--	--	--
Tt	Trix clay loam	51	I-1	VIIc	Loam Upland	1	1	68	11	70
Tu	Tucson loam	52	I-1	VIIc	Loam Upland	2	1	68	11	70
Tw	Tucson clay loam	52	I-1	VIIc	Loam Upland	2	1	68	11	70
Va	Valencia sandy loam	53	I-2	VIIc	Loam Upland	1	1	68	11	70
Vb	Valencia sandy loam, saline-alkali	53	IIs-9	VIIs	Saline Upland	5	1	68	11	70
Vc	Valencia gravelly sandy loam	54	I-2	VIIc	Loam Upland	1	1	68	11	70
Ve	Vecont loam	54	IIIs-8	VIIs	Clay Bottom	3	3	69	9	70

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Page	Capability unit and subclass Irrigated	Capability unit and subclass Dryland	Range site	Horticultural group	Wildlife habitat group Irrigated	Page	Wildlife habitat group Dryland	Page
			Symbol	Symbol	Name	Number				
Vf	Vecont clay	55	IIIs-3	VIIs	Clay Bottom	3	3	69	9	70
Vg	Vint loamy fine sand	55	IIIs-7	VIIs	Sandy Bottom	4	4	69	11	70
Vh	Vint fine sandy loam	55	IIs-7	VIIs	Sandy Bottom	4	2	69	11	70
Vk	Vint loam	55	IIs-7	VIIs	Sandy Bottom	4	2	69	11	70
Vn	Vint clay loam	56	IIs-7	VIIs	Sandy Bottom	4	2	69	11	70
Vr	Vint-Carrizo complex	56	------	VIIs	Sandy Bottom	4	---	--	--	--
	Vint soil	--	------	------	----------	---	---	--	11	70
	Carrizo soil	--	------	------	----------	---	---	--	12	71
Wg	Wintersburg complex	56	IIs-3	VIIs	----------	2	3	69	11	70

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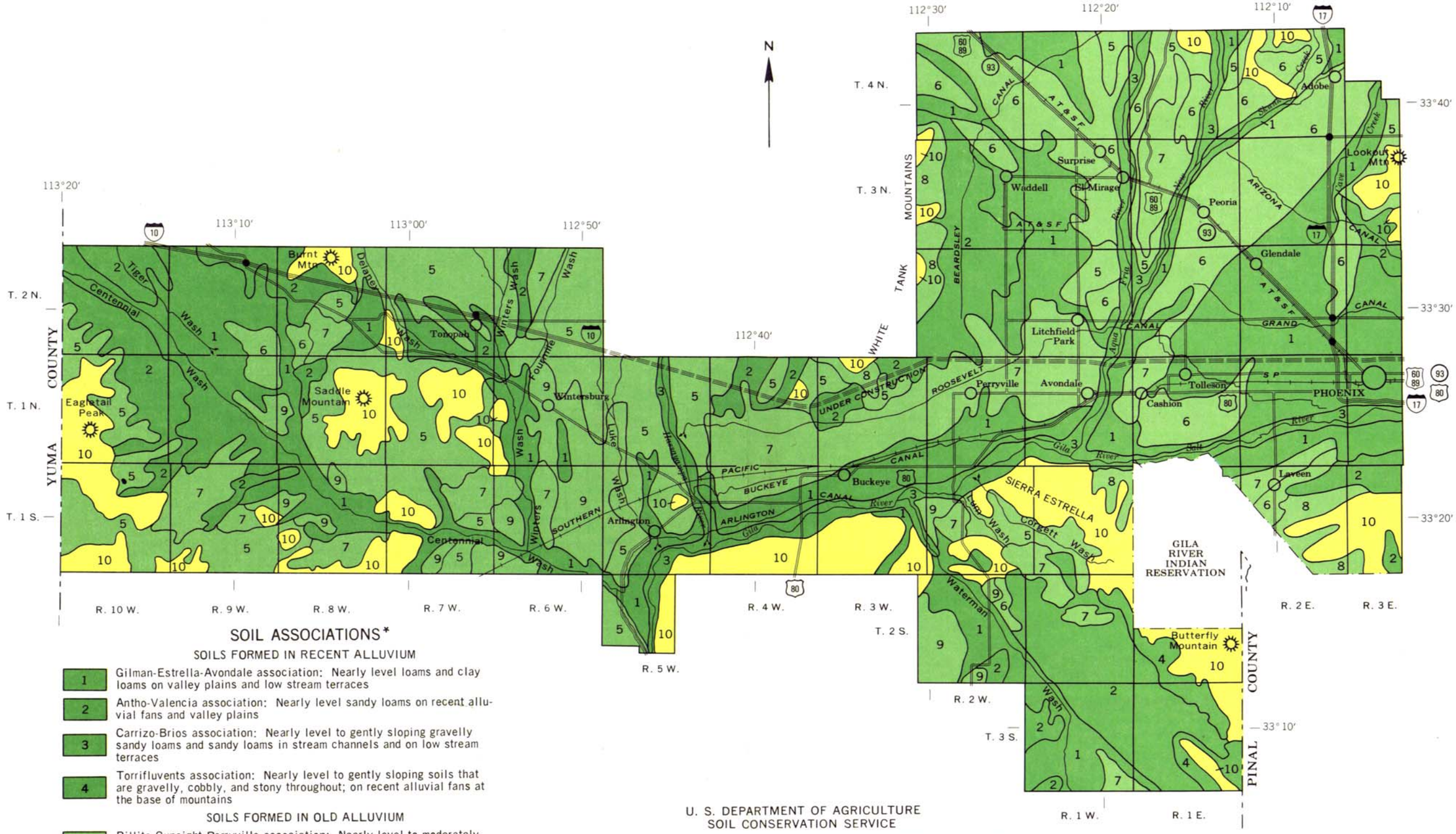


SOIL ASSOCIATIONS*

SOILS FORMED IN RECENT ALLUVIUM

1. Gilman-Estrella-Avondale association: Nearly level loams and clay loams on valley plains and low stream terraces
2. Antho-Valencia association: Nearly level sandy loams on recent alluvial fans and valley plains
3. Carrizo-Brios association: Nearly level to gently sloping gravelly sandy loams and sandy loams in stream channels and on low stream terraces
4. Torrifluvents association: Nearly level to gently sloping soils that are gravelly, cobbly, and stony throughout; on recent alluvial fans at the base of mountains

SOILS FORMED IN OLD ALLUVIUM

5. Rillito-Gunsight-Perryville association: Nearly level to moderately steep gravelly loams and loams on old alluvial fans and valley plains
6. Mohall-Laveen association: Nearly level loams and clay loams on old alluvial fans and valley plains
7. Laveen-Coolidge association: Nearly level sandy loams, loams, and clay loams on old alluvial fans and valley plains
8. Ebon-Pinamt-Tremant association: Nearly level to gently sloping gravelly loams, very cobbly loams, and gravelly clay loams on old alluvial fans at the base of mountains
9. Casa Grande-Harqua association: Nearly level to sloping, saline-alkali loams, sandy loams, and gravelly clay loams on valley plains

SOILS OF MOUNTAINS AND BUTTES

10. Cherioni-Rock outcrop association: Gently sloping to very steep very gravelly loams and Rock outcrop on mountains, buttes, and low hills

* The texture mentioned in the name of each association refers to the dominant texture of the surface layer of the major soils.

Compiled 1976

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

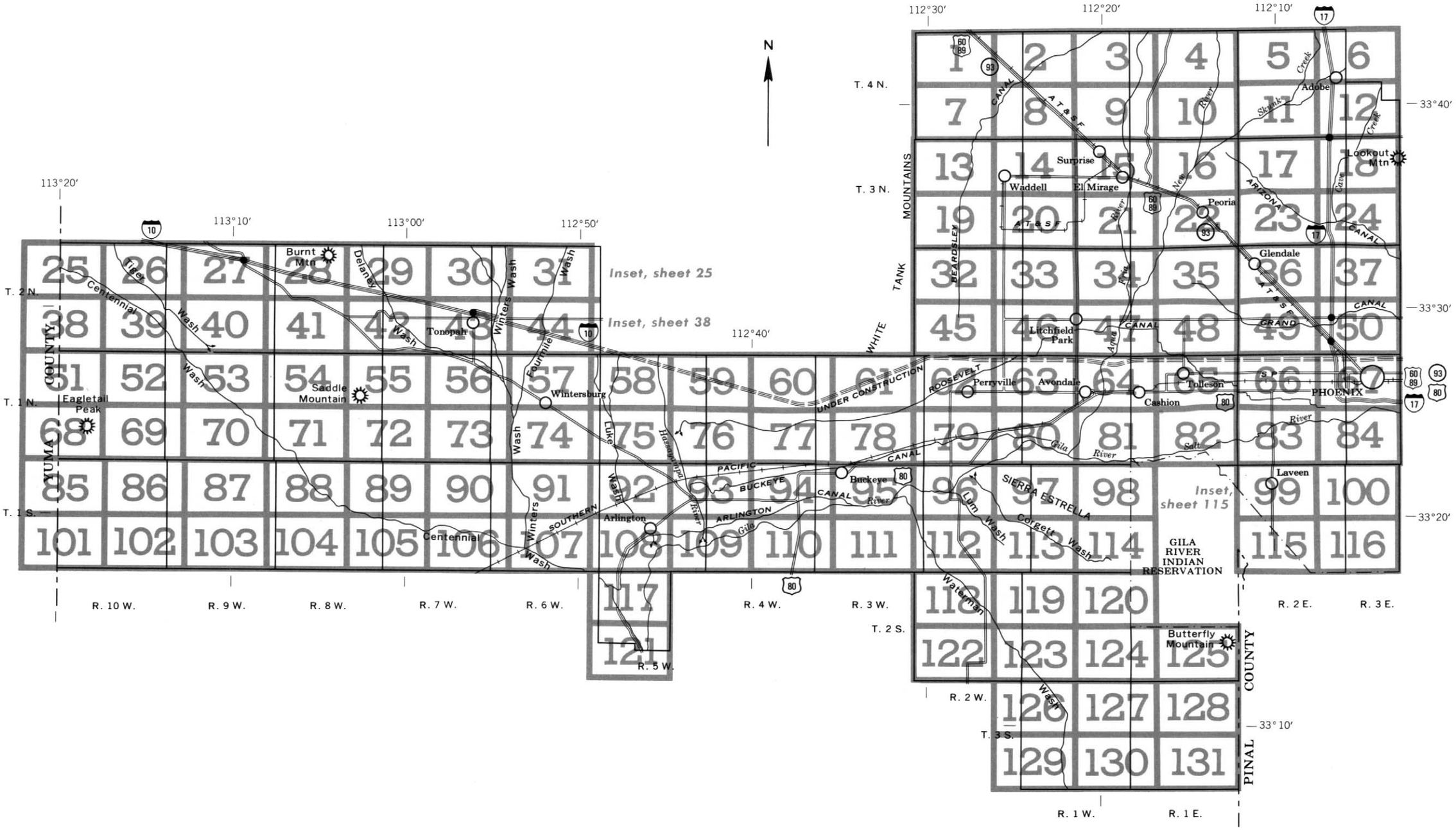
UNIVERSITY OF ARIZONA AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP

MARICOPA COUNTY, ARIZONA, CENTRAL PART

Scale 1:380,160
1 0 1 2 3 4 5 6 Miles

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.



Original text from each individual map sheet read:

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned

INDEX TO MAP SHEETS

MARICOPA COUNTY, ARIZONA, CENTRAL PART

Scale 1:380,160

1 0 1 2 3 4 5 6 Miles

SOIL LEGEND

The first letter, always a capital, is the initial letter of the soil name. The second letter is a capital if the mapping unit is broadly defined; otherwise, it is a small letter. The third letter, always a capital, A, B, C, D, or E, shows the slope. Most symbols without slope letters are those of nearly level soils but some are for miscellaneous land types, soil associations or undifferentiated groups with a fair to considerable range of slope. A final number, 2 or 3 in the symbol shows that the soil has been eroded.

SYMBOL	NAME
Aa	Agualt loam
AbA	Antho sandy loam, 0 to 1 percent slopes
AbB	Antho sandy loam, 1 to 3 percent slopes
Ac	Antho sandy loam, saline-alkali
AdA	Antho gravelly sandy loam, 0 to 1 percent slopes
AdB	Antho gravelly sandy loam, 1 to 3 percent slopes
Ae	Antho-Brios sandy loams
AfA	Antho-Carrizo complex, 0 to 1 percent slopes
AfB	Antho-Carrizo complex, 1 to 3 percent slopes
AGB	Antho-Carrizo complex, 0 to 3 percent slopes
AHC	Antho-Tremant complex, 1 to 5 percent slopes
AkB	Antho-Tremant-Mohall complex, 1 to 5 percent slopes
AL	Antho association
AM	Antho-Valencia association
An	Avonda clay loam
Ao	Avondale clay loam
Ap	Avondale clay loam, saline-alkali
BE	Beardsley loam
Br	Brios loamy sand
Bs	Brios sandy loam
Bt	Brios loam
CA2	Calciorthids and Torriorthents, eroded
Cb	Carrizo gravelly sandy loam
CeD	Carrizo-Ebon complex, 3 to 12 percent slopes
CF	Carrizo and Brios soils
Cg	Casa Grande sandy loam
Ch	Casa Grande loam
Ck	Casa Grande complex
Cm	Casa Grande-Laveen complex, alkali
Cn	Cashion clay, saline-alkali
CO	Cherioni-Rock outcrop complex
Cp	Coolidge sandy loam
CrB	Coolidge gravelly sandy loam, 1 to 3 percent slopes
Cs	Coolidge-Tremant complex
CV	Coolidge-Laveen association
Dn	Dune land
EbD	Ebon gravelly loam, 0 to 8 percent slopes
EPD	Ebon-Pinamt complex, 0 to 10 percent slopes
Es	Estrella loam
Et	Estrella loam, saline-alkali
GA	Gachado-Rock outcrop complex
Gb	Gadsden clay loam
Gc	Gadsden clay
Gd	Gadsden clay, saline-alkali
Ge	Gilman fine sandy loam
Gf	Gilman fine sandy loam, saline-alkali
GgA	Gilman loam, 0 to 1 percent slopes
GgB	Gilman loam, 1 to 3 percent slopes
Gh	Gilman loam, saline-alkali
GL	Gilman complex, saline-alkali
GM	Gilman-Antho association
GN	Gilman-Laveen association
Go3	Gilman, Antho and Glenbar soils, severely eroded
Gp	Gilman loam, clayey subsoil variant, moderately saline
Gr	Glenbar loam
Gs	Glenbar loam, saline-alkali
Gt	Glenbar clay loam
Gu	Glenbar clay loam, saline-alkali
Gv	Glenbar clay
GWD	Gunsight-Pinal complex, 1 to 10 percent slopes
GxA	Gunsight-Rillito complex, 0 to 1 percent slopes
GxB	Gunsight-Rillito complex, 1 to 3 percent slopes
GYD	Gunsight-Rillito complex, 0 to 10 percent slopes
HAB	Harqua complex, 0 to 3 percent slopes
HAC	Harqua complex, 3 to 8 percent slopes
HLC	Harqua-Gunsight complex, 0 to 5 percent slopes
HM	Harqua-Laveen complex
HrB	Harqua-Rillito complex, 1 to 3 percent slopes
La	La Palma very fine sandy loam
Lb	Laveen sandy loam
LcA	Laveen loam, 0 to 1 percent slopes
LcB	Laveen loam, 1 to 3 percent slopes
Ld	Laveen loam, saline-alkali
Le	Laveen clay loam
Lf	Laveen-Antho complex, saline-alkali
Ma	Maripo sandy loam
Mo	Mohall sandy loam
Mp	Mohall loam
Mr	Mohall clay loam
Ms	Mohall clay
MTB	Mohall-Tremant complex, 0 to 3 percent slopes
MV	Mohall-Laveen association
Pa	Perryville sandy loam
Pb	Perryville loam, saline-alkali
PeA	Perryville gravelly loam, 0 to 1 percent slopes
PeB	Perryville gravelly loam, 1 to 3 percent slopes
PRB	Perryville-Rillito complex, 0 to 3 percent slopes
PsA	Pinal loam, 0 to 1 percent slopes
PsB	Pinal loam, 1 to 3 percent slopes
PT	Pinal gravelly loam
PvB	Pinal-La Palma loams, 1 to 3 percent slopes
PWB	Pinal-Suncity complex, 0 to 3 percent slopes
PYD	Pinamt-Tremant complex, 1 to 10 percent slopes
RaA	Rillito sandy loam, 0 to 1 percent slopes
RaB	Rillito sandy loam, 1 to 3 percent slopes
RbA	Rillito loam, 0 to 1 percent slopes
RbB	Rillito loam, 1 to 3 percent slopes
RhB	Rillito-Harqua complex, 1 to 3 percent slopes
RpE	Rillito-Perryville complex, 5 to 20 percent slopes
RS	Rock outcrop-Cherioni complex
Ta	Toltec loam
TB	Torrifluvents
Tc	Torriorthents
TD	Torripsamments and Torrifluvents, frequently flooded
Te	Tremant loam
TfA	Tremant gravelly loam, 0 to 1 percent slopes
TfB	Tremant gravelly loam, 1 to 3 percent slopes
Tg	Tremant clay loam
Th	Tremant gravelly clay loam
TPB	Tremant complex, 0 to 3 percent slopes
TrA	Tremant-Rillito complex, 0 to 1 percent slopes
TrB	Tremant-Rillito complex, 1 to 3 percent slopes
TSC	Tremant-Rillito complex, 0 to 5 percent slopes
Tt	Trix clay loam
Tu	Tucson loam
Tw	Tucson clay loam
Va	Valencia sandy loam
Vb	Valencia sandy loam, saline-alkali
Vc	Valencia gravelly sandy loam
Ve	Vecont loam
Vf	Vecont clay
Vg	Vint loamy fine sand
Vh	Vint fine sandy loam
Vk	Vint loam
Vn	Vint clay loam
Vr	Vint-Carrizo complex
Wg	Wintersburg complex

MARICOPA COUNTY, ARIZONA, CENTRAL PART

CONVENTIONAL SIGNS

WORKS AND STRUCTURES

Highways and roads
- Divided
- Good motor
- Poor motor
- Trail

Highway markers
- National Interstate
- U. S.
- State or county

Railroads
- Single track
- Multiple track
- Abandoned

Bridges and crossings
- Road
- Trail
- Railroad
- Ferry (FY)
- Ford (FORD)
- Grade
- R. R. over
- R. R. under

Buildings
- School
- Church

Mine and quarry

Gravel pit (G.P.)

Power line

Pipeline

Cemetery

Dams

Levee

Tanks

Cotton gin

Forest fire or lookout station

Windmill

Located object

BOUNDARIES

- National or state
- County
- Limit of soil survey
- Reservation
- Land grant
- Small park, cemetery, airport
- Land survey division corners

DRAINAGE

Streams, double-line
- Perennial
- Intermittent

Streams, single-line
- Perennial
- Intermittent
  - Crossable with tillage implements
  - Not crossable with tillage implements
  - Unclassified

Canals and ditches, single line irrigation

Lakes and ponds
- Perennial (water, w)
- Intermittent (int)

Well, irrigation

Marsh or swamp

Wet spot

Drainage end or alluvial fan

RELIEF

Escarpments
- Bedrock
- Other

Short steep slope

Prominent peak

Depressions

	Large	Small
Crossable with tillage implements		
Not crossable with tillage implements		
Contains water most of the time		

SOIL SURVEY DATA

- Soil boundary and symbol (Dx)
- Gravel
- Stoniness
  - Stony
  - Very stony
- Rock outcrops
- Chert fragments
- Clay spot
- Sand spot
- Gumbo or scabby spot
- Made land
- Severely eroded spot
- Blowout, wind erosion
- Gully
- Borrow pit (B.P.)
- Disposal pit (D. P.)
- Kitchen midden
- Saline spot
- Sand area
- Sanitary landfill
- Elongated, course textured soil bodies
- Soils with gravelly subsoils of less than 1 acre
- Soils with gravelly subsoils of 1 to 2 acres

MARICOPA COUNTY, ARIZONA, CENTRAL PART — SHEET NUMBER 1

(1)

N

320 000 FEET

990 000 FEET

R. 2 W.

T. 4 N.

LIMIT OF SOIL SURVEY

LUKE AIR FORCE AUXILIARY FIELD NO 1

ATCHISON TOPEKA AND SANTA FE

Beardsley

60 89 93

MTB GM AGB TSC Ve Th AdA

6 5 / 7 8

5 4 / 8 9

8 9 / 17 16

9 10 / 16 15

10 11 / 15 14

18 17

16 15

(Joins sheet 2)

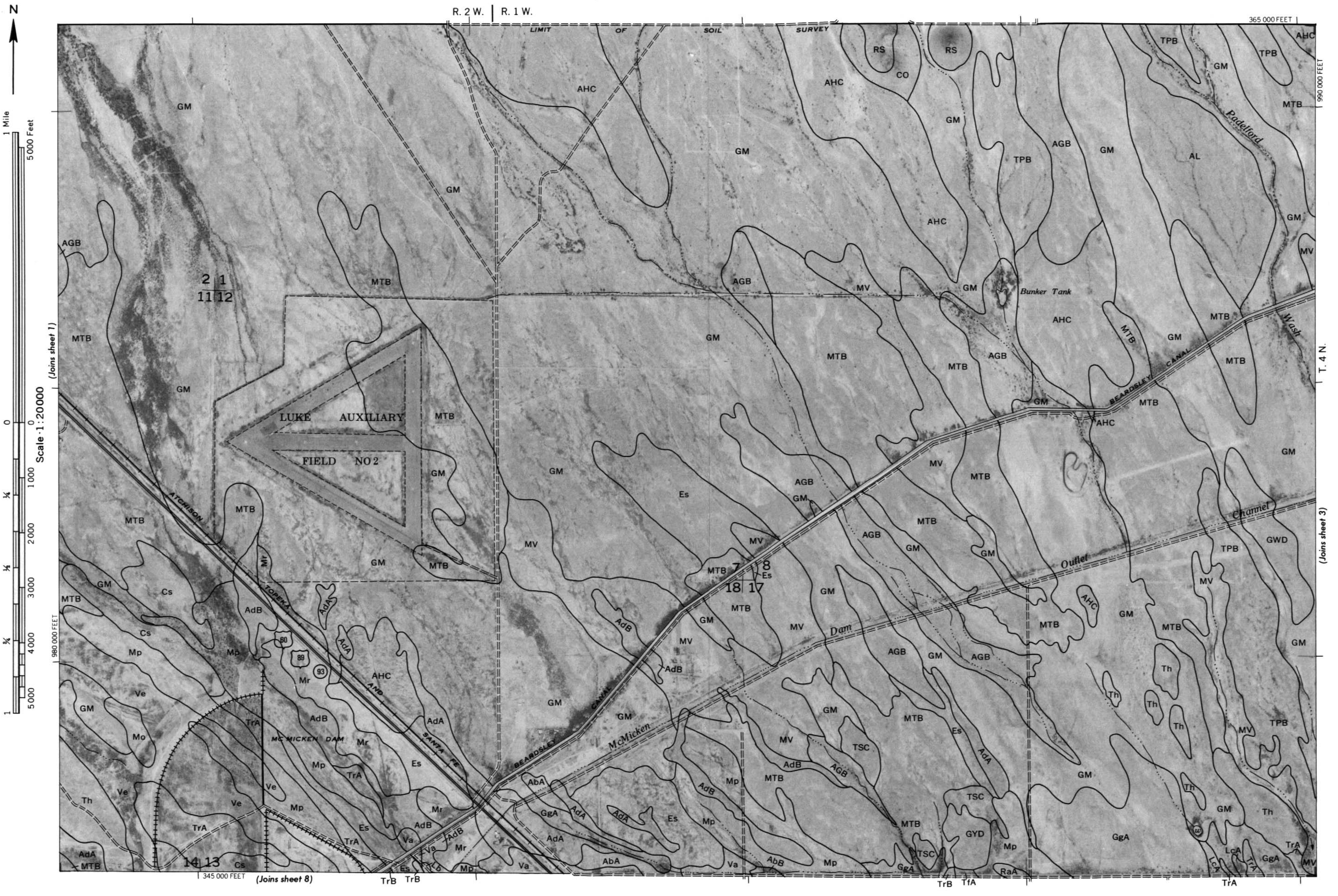
(Joins sheet 7)

980 000 FEET

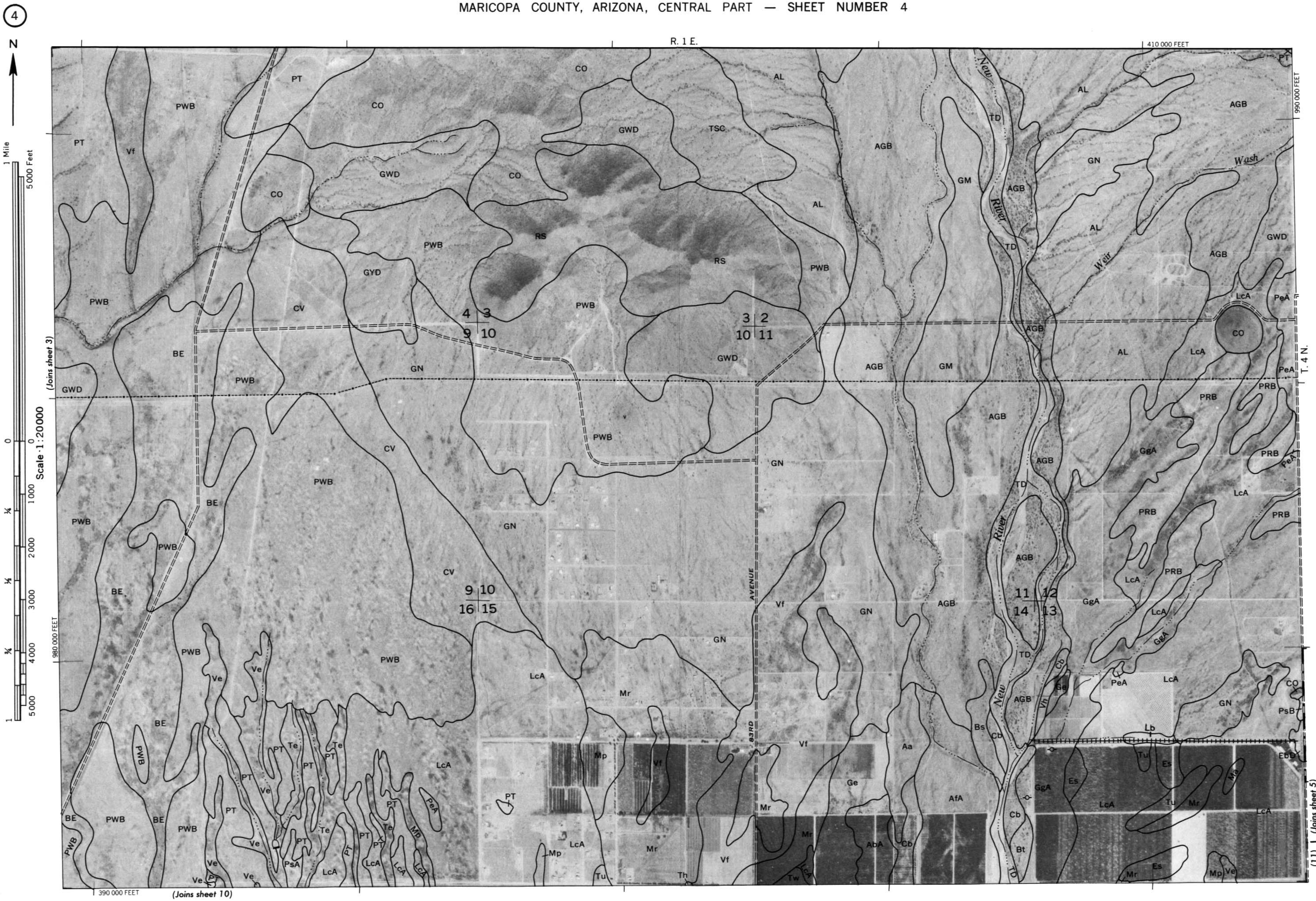
340 000 FEET

1 Mile 5000 Feet

Scale 1:20000


N
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
R. 2 W.
R. 1 W.
365 000 FEET
990 000 FEET
980 000 FEET
345 000 FEET
T. 4 N.
(Joins sheet 1)
(Joins sheet 3)
(Joins sheet 8)
LIMIT OF SOIL SURVEY
LUKE AUXILIARY FIELD NO 2
Bunker Tank
Padelford Wash
BEARDSLEY CANAL
McMicken Dam Outlet Channel
MC MICKEN DAM
ATCHISON TOPEKA AND SANTA FE
60
89
93
2 1
11 12
7 8
18 17
14 13
GM
AHC
RS
CO
TPB
MTB
AGB
AL
MV
Es
AdB
AdA
Cs
Mp
Mr
Ve
Mo
Th
TrA
Va
Lb
TrB
AbA
GgA
TSC
GYD
RaA
TfA
GWD
LcA


3
N
R. 1 W. | R. 1 E.
T. 4 N.
370 000 FEET
990 000 FEET
980 000 FEET
385 000 FEET
BEARDSLEY CANAL
McMicken Dam Outlet Channel
Padelford Wash
Agua Fria River
(Joins sheet 2)
(Joins sheet 4)
(Joins sheet 9)
Scale 1:20000
1 Mile
5000 Feet
0
1000
2000
3000
4000
5000
¼
½
¾
1
water


4
N
1 Mile
5000 Feet
0
0
1000
¼
2000
½
3000
¾
4000
1
5000
Scale 1:20000
R. 1 E.
410 000 FEET
990 000 FEET
980 000 FEET
390 000 FEET
T. 4 N.
(Joins sheet 3)
(Joins sheet 5)
(Joins sheet 10)
(11)
New River
Weir Wash
83RD AVENUE
PT
PWB
Vf
CO
GWD
TSC
AL
AGB
GM
TD
GN
RS
GYD
CV
BE
LcA
PeA
PRB
GgA
Mr
Mp
Ve
Te
PsA
Md
Tu
Th
Tw
Ge
Aa
AfA
AbA
Cb
Bt
Bs
Vh
Es
Lb
EbD
PsB
Ma

415 000 FEET

R. 2 E.

990 000 FEET

T. 4 N.

Ludden Mountain

DEEM HILLS

DEEM HILLS

THUNDERBIRD PARK

HEDGPETH HILLS

PINNACLE PEAK ROAD

DEER VALLEY

Wash

Creek

Skunk

(Joins sheet 4)

(Joins sheet 6)

(Joins sheet 11)

435 000 FEET

980 000 FEET

N

1 Mile

5 000 Feet

Scale 1:20000

N

R. 2 E.

455 000 FEET

990 000 FEET

T. 4 N.

980 000 FEET

440 000 FEET

1 Mile

5000 Feet

Scale·1:20000

0 1000 2000 3000 4000 5000

1 ¼ ½ ¾ 1

AGB Creek

Skunk Creek

LITTLE DEER VALLEY

PINNACLE PEAK ROAD

Adobe Mountain

Wash

SOIL SURVEY LIMIT OF SOIL SURVEY

(Joins sheet 5)

(Joins sheet 12)

Ma TD GgA PeA Aa Tu GYD RS TSC Vf LcA Th Tw Mr AfA AdA RaA GxA RbA TPB PT Es RbA Mp TfA Tg

2 1 11 12 14 13

320 000 FEET

R. 2 W.

(Joins sheet 1)

975 000 FEET

T. 4 N.

N

1 Mile

5000 Feet

Scale 1:20000

(Joins sheet 8)

965 000 FEET

Trilby Wash

BASIN DETENTION

WASH

TRILBY

BEARDSLEY CANAL

BELL ROAD

WHITE TANK MOUNTAINS

(Joins sheet 13)

340 000 FEET

30 29 31 32

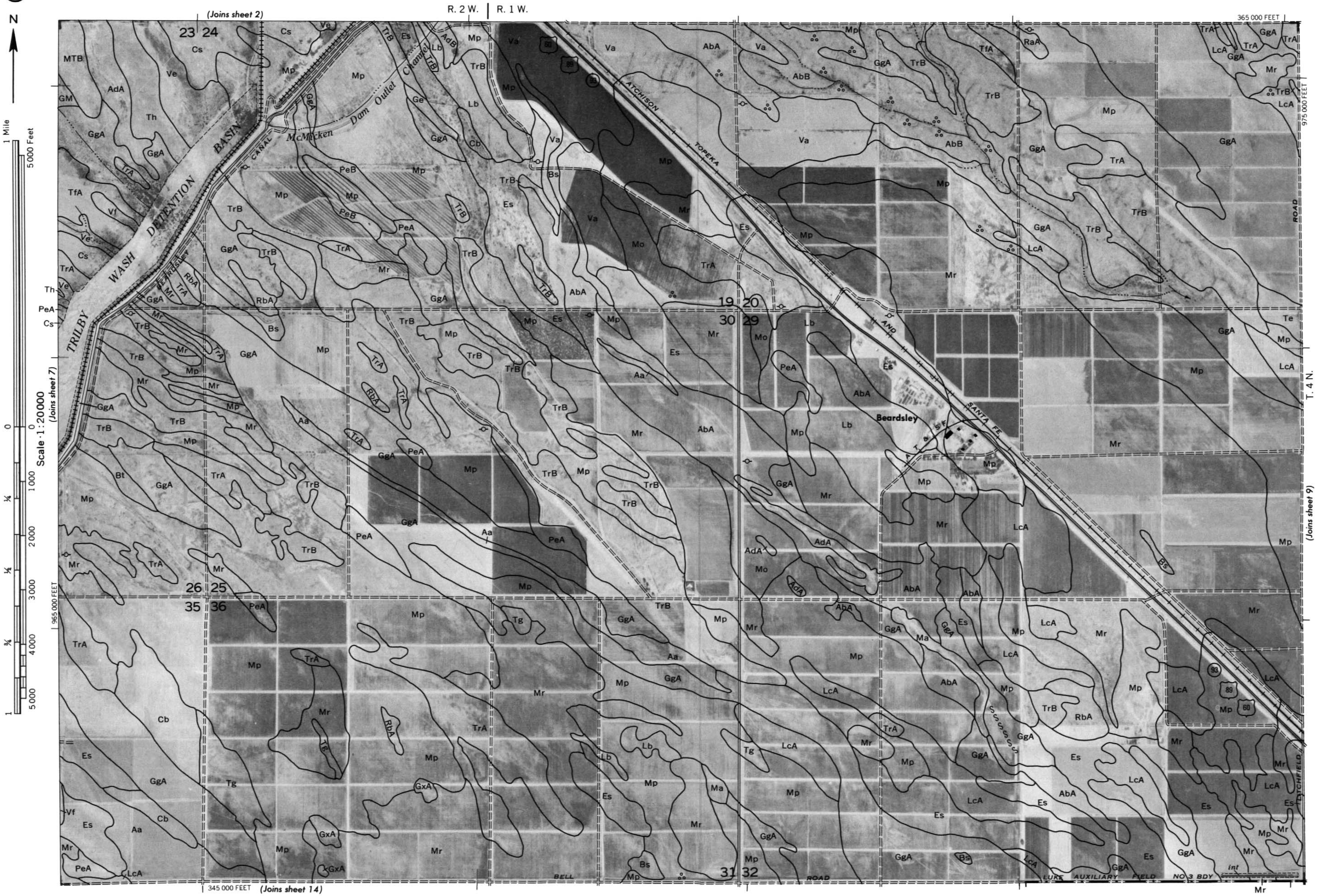
29 28 32 33

28 27 33 34

32 33 32 33

TSC GM MTB PRB AGB AL EPD CO RS GgA TrB TrA Ve Vf Mp Mr Cp Cs Es Th PeA Aa Bs Ma Mo CrB Vr Tg Ae AdA Lb Te RbA

MARICOPA COUNTY, ARIZONA, CENTRAL PART — SHEET NUMBER 8



N

R. 1 W. | R. 1 E.

T. 4 N.

370 000 FEET

975 000 FEET

965 000 FEET

385 000 FEET

(Joins sheet 3)

(Joins sheet 8)

(Joins sheet 10)

(Joins sheet 15)

Lizard Acres

Calderwood Station

Aqua Fria River

ATCHISON, TOPEKA AND SANTA FE

LITCHFIELD ROAD

BELL ROAD

1 Mile

5000 Feet

Scale 1:20000


N
1 Mile
5 000 Feet
Scale 1:20000
(Joins sheet 4)
R. 1 E.
410 000 FEET
975 000 FEET
(Joins sheet 9)
(Joins sheet 11)
T. 4 N.
965 000 FEET
390 000 FEET
(Joins sheet 16)
New River
DEER VALLEY
83RD AVENUE
BELL ROAD
GRAVEL PIT
Skunk Creek
Airstrip
water
int
21 22
28 27
23 24
26 25
33 34

MARICOPA COUNTY, ARIZONA, CENTRAL PART — SHEET NUMBER 11

11

N

415 000 FEET

R. 2 E.

(Joins sheet 10) (4)

975 000 FEET

(Joins sheet 5)

T. 4 N.

(Joins sheet 12)

965 000 FEET

435 000 FEET

(Joins sheet 17)

THUNDERBIRD PARK BDY

HEDGPETH HILLS

Skunk Creek

Scatter Wash

Sierra Vista School

59TH AVENUE

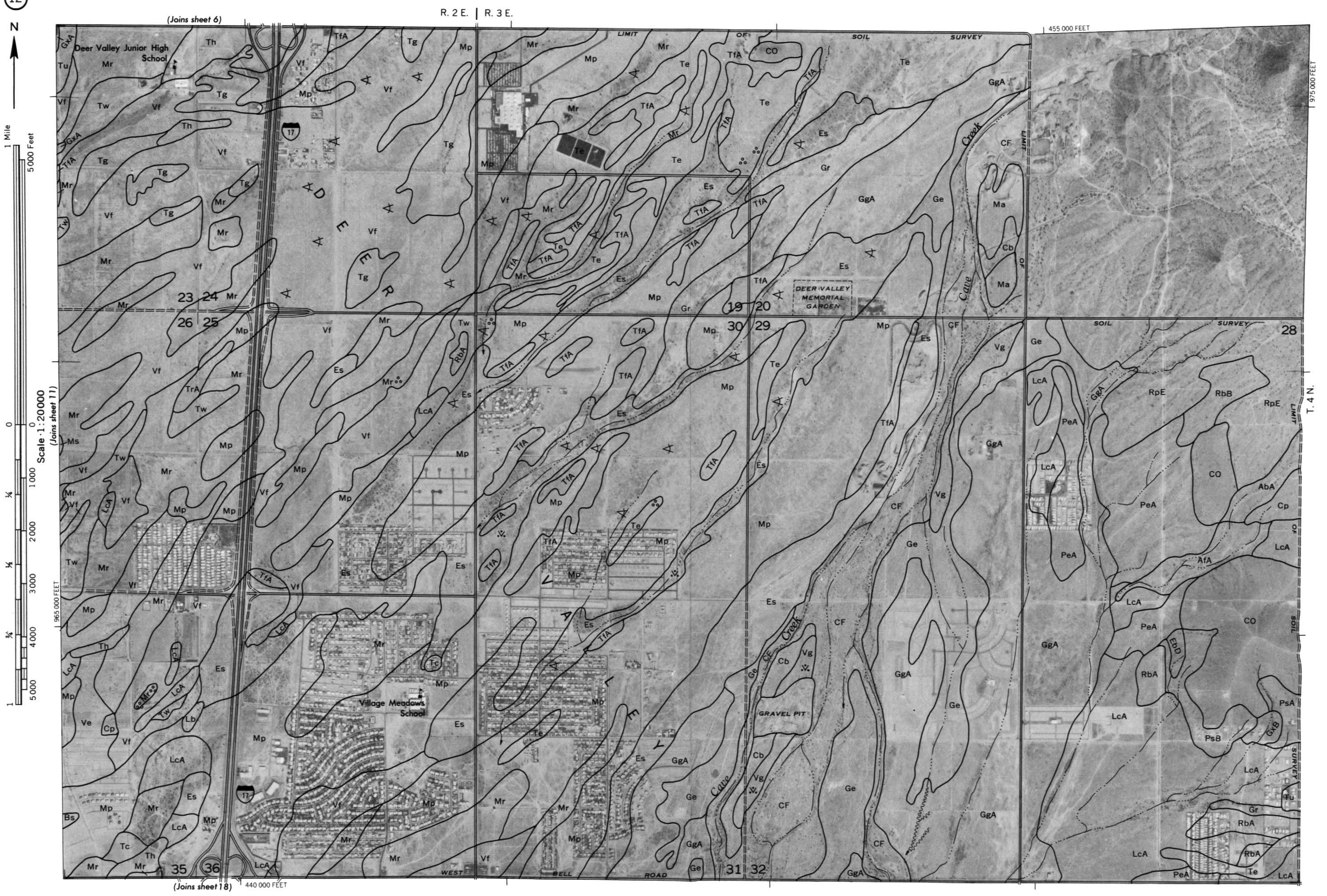
BELL ROAD

intermittent

1 Mile 0 5000 Feet

Scale 1:20000

1 1000 2000 3000 4000 5000


12
N
(Joins sheet 6)
R. 2 E.
R. 3 E.
455 000 FEET
975 000 FEET
LIMIT OF SOIL SURVEY
Deer Valley Junior High School
DEER VALLEY MEMORIAL GARDEN
D E E R V A L L E Y
Cave Creek
GRAVEL PIT
Village Meadows School
WEST BELL ROAD
T. 4 N.
965 000 FEET
(Joins sheet 11)
Scale 1:20000
1 Mile
5000 Feet
(Joins sheet 18)
440 000 FEET
23 24 26 25 19 20 30 29 28 35 36 31 32

13

N

R. 2 W.

320 000 FEET

960 000 FEET

T. 3 N.

(Joins sheet 7)

(Joins sheet 14)

(Joins sheet 19)

340 000 FEET

945 000 FEET

WHITE TANK MOUNTAINS

BELL ROAD

BASIN

TANK

BEARDSLEY CANAL

DETENTION BASIN

WASH

TRILBY WASH

6 5
7 8

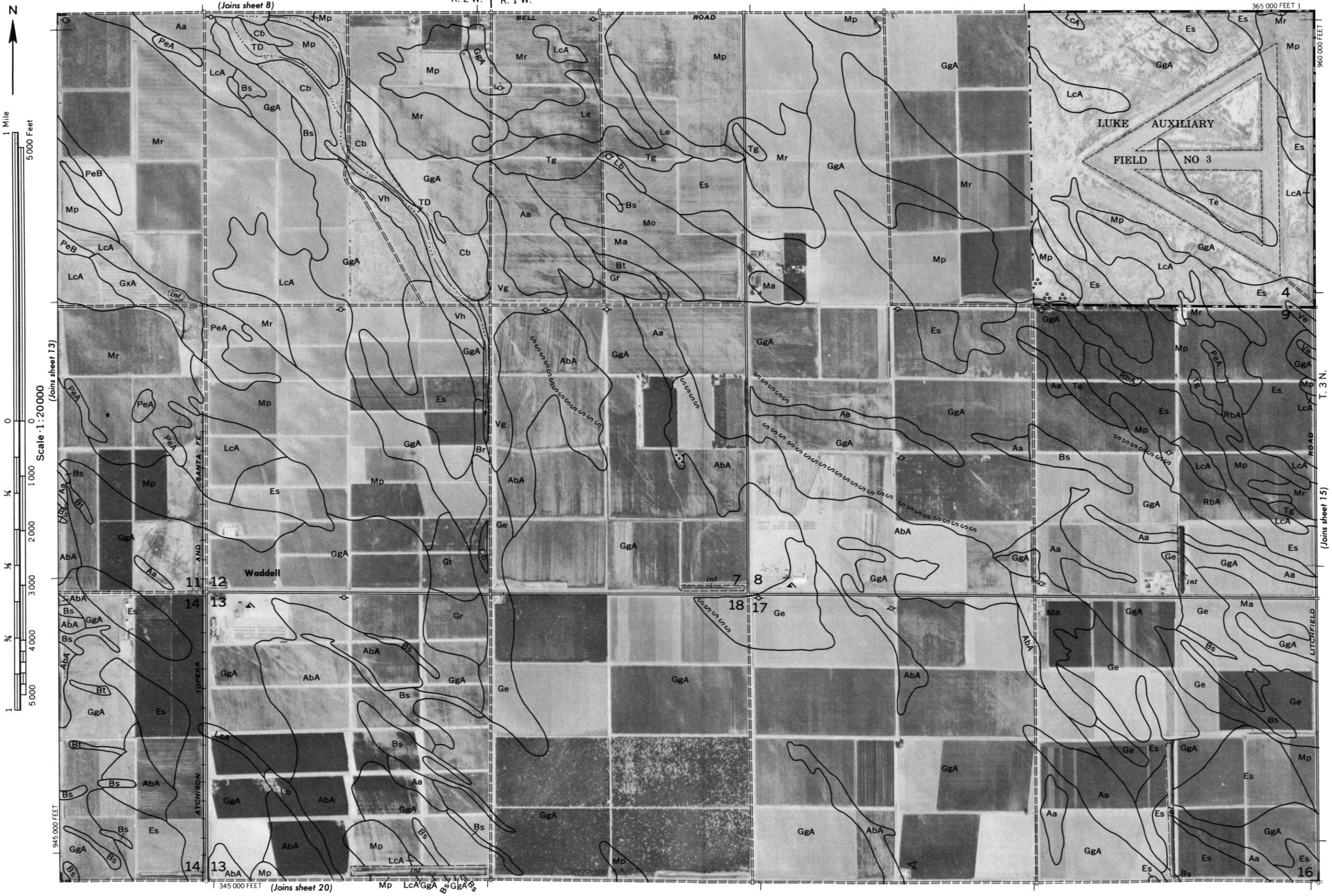
7 8
18 17

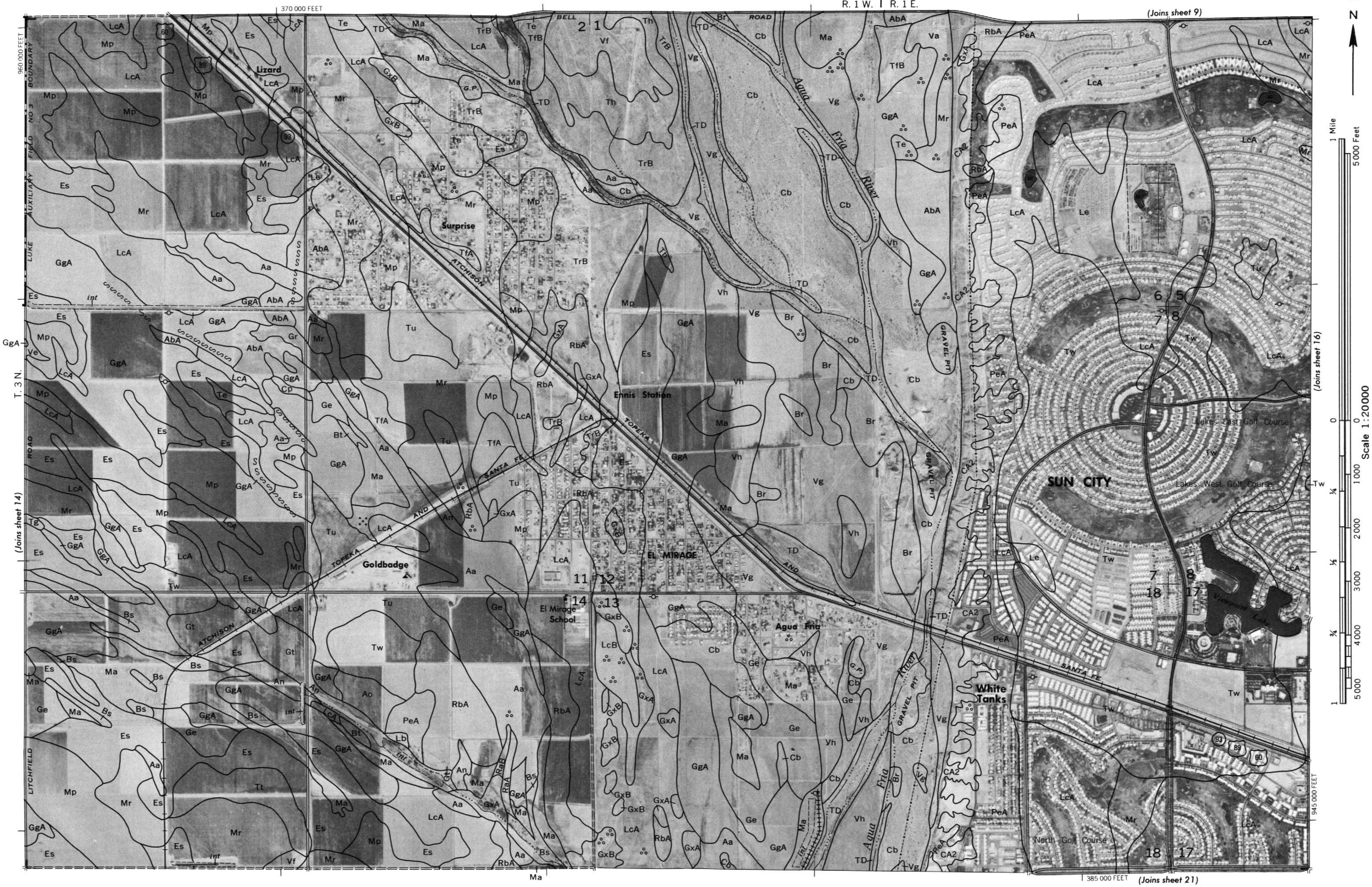
9 10
16 15

1 Mile 0 5000 Feet

Scale 1:20000

1 0 1000 2000 3000 4000 5000


R. 2 W.
R. 1 W.
(Joins sheet 8)
365 000 FEET
960 000 FEET
BELL ROAD
LUKE AUXILIARY
FIELD NO 3
T. 3 N.
(Joins sheet 13)
(Joins sheet 15)
(Joins sheet 20)
945 000 FEET
345 000 FEET
SANTA FE
AND
TOPEKA
ATCHISON
LITCHFIELD
ROAD
Waddell
N
1 Mile
5000 Feet
Scale · 1:20000



370 000 FEET
R. 1 W. | R. 1 E.
(Joins sheet 9)
N
960 000 FEET
BELL ROAD
Lizard
Surprise
ATCHISON
TOPEKA
SANTA FE
Ennis Station
Goldbadge
EL MIRAGE
El Mirage School
Agua Fria
White Tanks
SUN CITY
Lakes East Golf Course
Lakes West Golf Course
North Golf Course
Viewpoint Lake
Agua Fria River
GRAVEL PIT
LUKE AUXILIARY FIELD NO 3 BOUNDARY
LITCHFIELD ROAD
T. 3 N.
(Joins sheet 14)
(Joins sheet 16)
(Joins sheet 21)
385 000 FEET
945 000 FEET
1 Mile
5000 Feet
Scale 1:20000

N

(Joins sheet 10)

R. 1 E.

410 000-FEET

1 Mile

5000 Feet

Scale 1:20000

(Joins sheet 15)

SUN CITY

Dawn Lake

New River

Skunk Creek

BELL ROAD

THUNDERBIRD ROAD

83RD AVENUE

ARIZONA CANAL

DISPOSAL PIT

Weedville

ATCHISON TOPEKA AND SANTA FE

S. Golf Course

T. 3 N.

955 000 FEET

945 000 FEET

390 000 FEET

(Joins sheet 17)

(Joins sheet 22)

MARICOPA COUNTY, ARIZONA, CENTRAL PART — SHEET NUMBER 17

17

N

R. 2 E.

(Joins sheet 11)

415 000 FEET

955 000 FEET

T. 3 N.

(Joins sheet 16)

(Joins sheet 18)

(Joins sheet 23)

945 000 FEET

435 000 FEET

1 Mile

5000 Feet

Scale 1:20000

American Institute for Foreign Trade

BELL ROAD

THUNDERBIRD ROAD

59TH AVENUE

ARIZONA CANAL

PHOENIX
(county seat)


N
Scale 1:20000
1 Mile
5000 Feet
(Joins sheet 12)
(Joins sheet 17)
(Joins sheet 24)
R. 2 E.
R. 3 E.
T. 3 N.
455 000 FEET
960 000 FEET
945 000 FEET
440 000 FEET
WEST BELL ROAD
THUNDERBIRD ROAD
Turf Paradise
GRAVEL PIT
Cave Creek
Moon Hill
Moon Valley Country Club
Lookout Mountain
DEER VALLEY
PHOENIX (county seat)
Shaw Butte School
Shaw Butte
PHOENIX MOUNTAINS
SURVEY BDY.

320 000 FEET

R. 2 W.

(Joins sheet 13)

940 000 FEET

T. 3 N.

WHITE TANK MOUNTAINS

TRILBY WASH DETENTION BASIN

BEARDSLEY CANAL

N

1 Mile

5000 Feet

Scale 1:20000

(Joins sheet 20)

930 000 FEET

33 34

(Joins sheet 32)

340 000 FEET

N

1 Mile 5000 Feet

0 0

Scale 1:20000

¼ 1000

½ 2000

¾ 3000

1 4000 5000

R. 2 W. | R. 1 W.

(Joins sheet 14)

365 000 FEET

940 000 FEET

T. 3 N.

(Joins sheet 19)

(Joins sheet 21)

930 000 FEET

345 000 FEET

(Joins sheet 33)

Fennemore

Wayne

LUKE AIR FORCE BASE

SANTA FE

ATCHISON TOPEKA AND SANTA FE

LITCHFIELD PARK

int

BDY

N

1 Mile 5000 Feet

0 0

Scale 1:20000

1 5000 4000 3000 2000 1000

¾ ¾ ½ ¼

370 000 FEET

940 000 FEET

930 000 FEET

385 000 FEET

T. 3 N.

R. 1 W. | R. 1 E.

(Joins sheet 15)

(Joins sheet 20)

(Joins sheet 22)

(Joins sheet 34)

Youngtown

North Golf Course

South Golf Course

SUN CITY

Dysart School

Bumstead

GRAVEL PIT

Agua Fria River

SANTA FE

TOPEKA AND

ATCHISON

LITCHFIELD ROAD

19 20 23 24 25 26 31 32 35 36

N

(Joins sheet 16)

R. 1 E.

410 000 FEET

940 000 FEET

T. 3 N.

(Joins sheet 21)

(Joins sheet 23)

930 000 FEET

390 000 FEET

(Joins sheet 35)

Scale · 1:20000

1 Mile 5000 Feet

0 0

¼ 1000

½ 2000

¾ 3000

1 4000

1¼ 5000

South Golf Course

SUN CITY

GRAVEL PIT

New River

WATER TREATMENT PLANT

water

inf

DUMP

G.P.

PEORIA

ATCHISON, TOPEKA AND SANTA FE

CENTRAL AVENUE

83RD AVENUE

Airstrip

AGUA FRIA STEAM PLANT

AT & SF

21 22 23 24

28 27 26 25

33 34 35 36

415 000 FEET

R. 2 E.

(Joins sheet 17)

940 000 FEET

T. 3 N.

(Joins sheet 22)

(Joins sheet 24)

930 000 FEET

(Joins sheet 36)

435 000 FEET

N

1 Mile

5000 Feet

Scale 1:20000

PHOENIX
(county seat)

ARIZONA CANAL

59TH AVENUE

GLENDALE COMMUNITY COLLEGE

DEER VALLEY FILTRATION PLANT

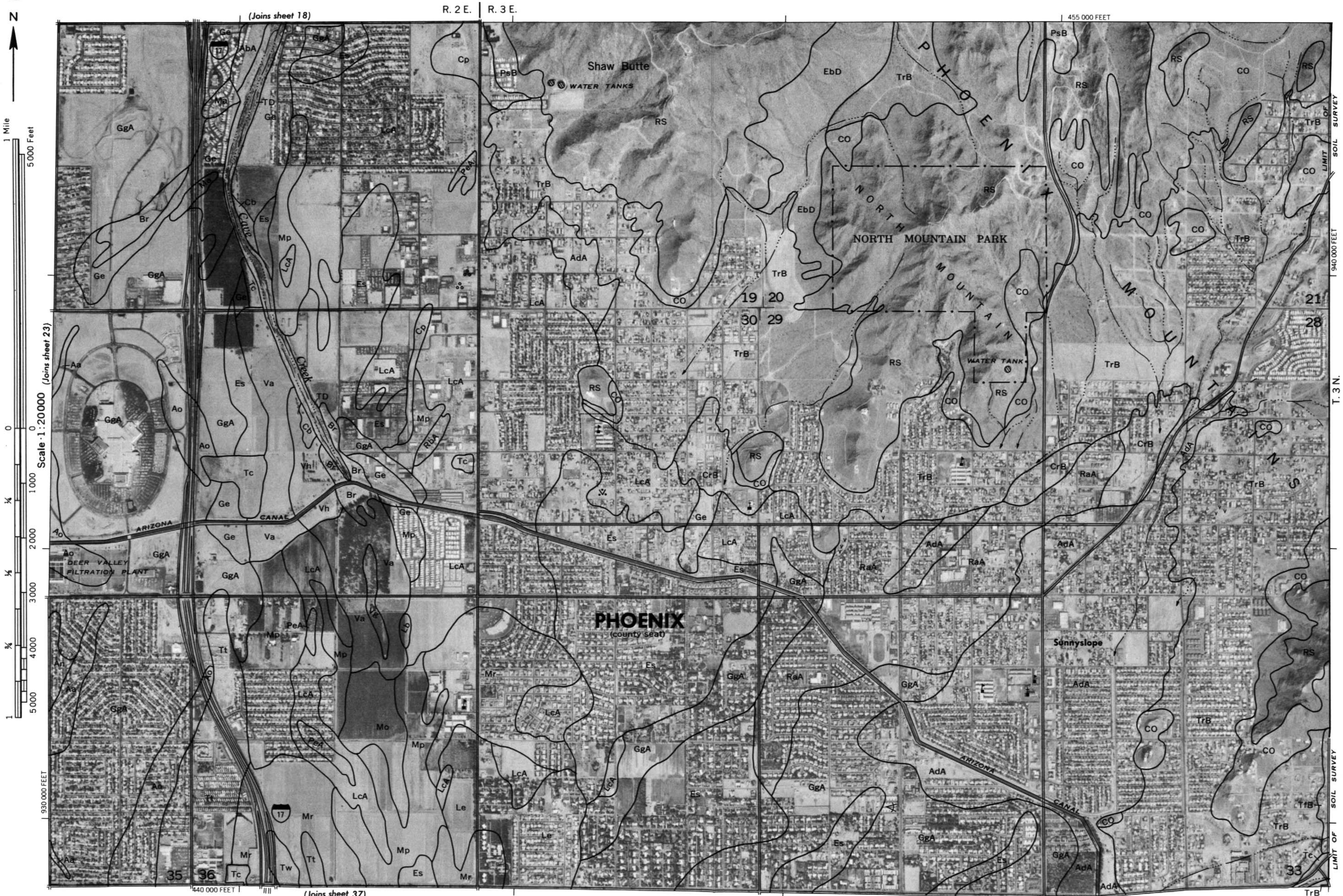
Cortez High School

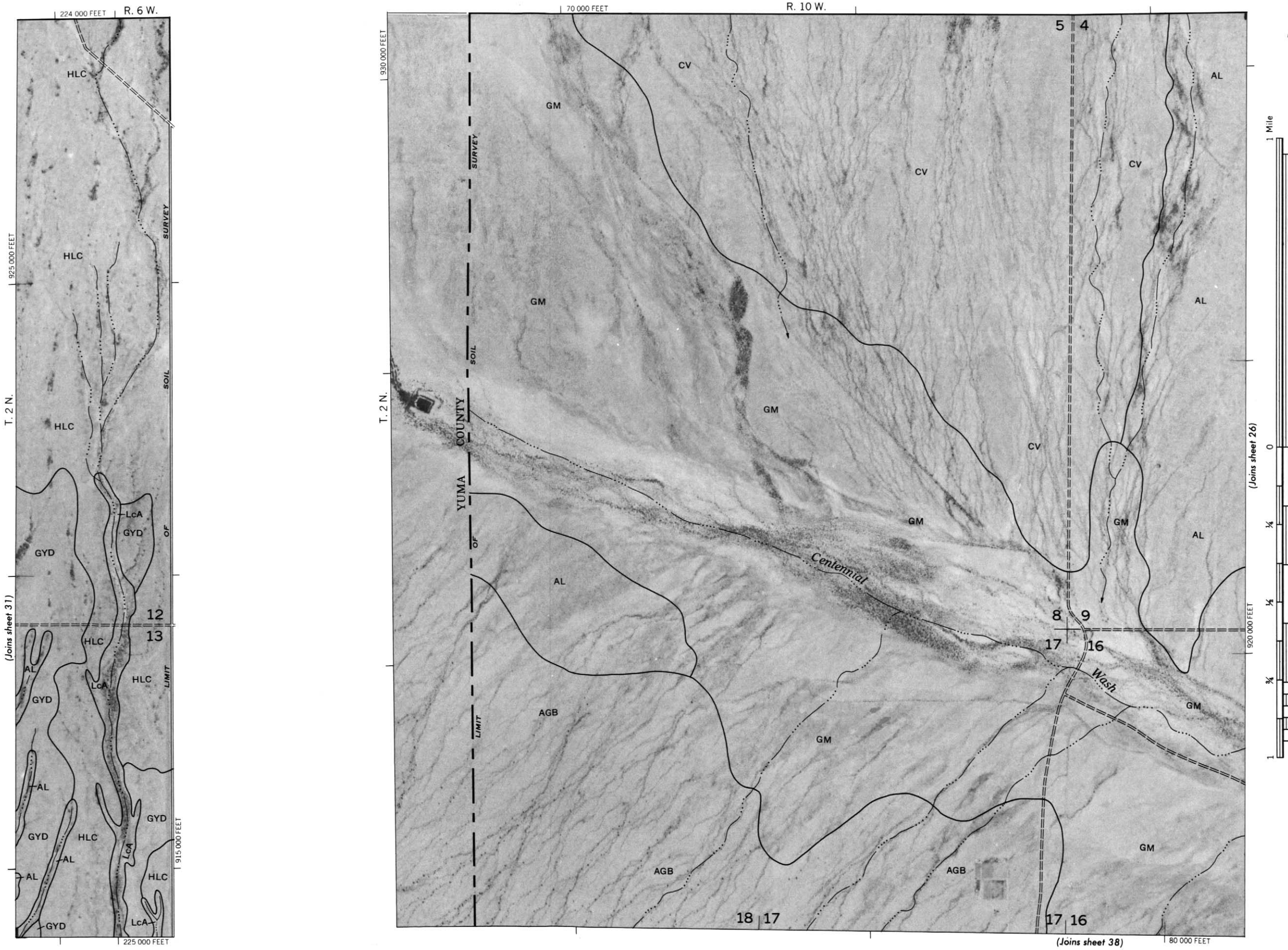
Manzanita School

REST HAVEN CEMETERY

Golf Course

19 20 21 22
30 29 28 27
31 32 33 34


(Joins sheet 18)
R. 2 E.
R. 3 E.
455 000 FEET
N
1 Mile
5 000 Feet
Scale 1:20000
(Joins sheet 23)
Shaw Butte
WATER TANKS
PHOENIX MOUNTAINS
NORTH MOUNTAIN PARK
NORTH MOUNTAIN
WATER TANK
Cave Creek
ARIZONA CANAL
DEER VALLEY FILTRATION PLANT
PHOENIX
(county seat)
Sunnyslope
940 000 FEET
930 000 FEET
440 000 FEET
T. 3 N.
LIMIT OF SOIL SURVEY
19
20
30
29
21
28
35
36
33
(Joins sheet 37)



1000 AND 5000-FOOT GRID TICKS

N

Scale 1:20000

1 Mile 5000 Feet

0 1000 2000 3000 4000 5000

0 ¼ ½ ¾ 1

R. 10 W. | R. 9 W.

105 000 FEET

930 000 FEET

920 000 FEET

85 000 FEET

T. 2 N.

BORROW PIT

HARQUAHALA PLAINS

Tiger Wash

Centennial Wash

(Joins sheet 25)

(Joins sheet 27)

(Joins sheet 39)

110 000 FEET

R. 9 W.

930 000 FEET

T. 2 N.

BUCKEYE — SALOME ROAD

BORROW PIT

HLC

AM

AGB

AdA

AL

Tu

GYD

Ma

AbA

Va

Ge

Es

Cp

Pa

Ae

Lb

LcA

GgA

Aa

TfA

Te

Cb

AfA

SALOME ROAD

HARQUAHALA PLAINS

Mary E. Ranch

Blecha Ranch

(Joins sheet 26)

(Joins sheet 28)

(Joins sheet 40)

915 000 FEET

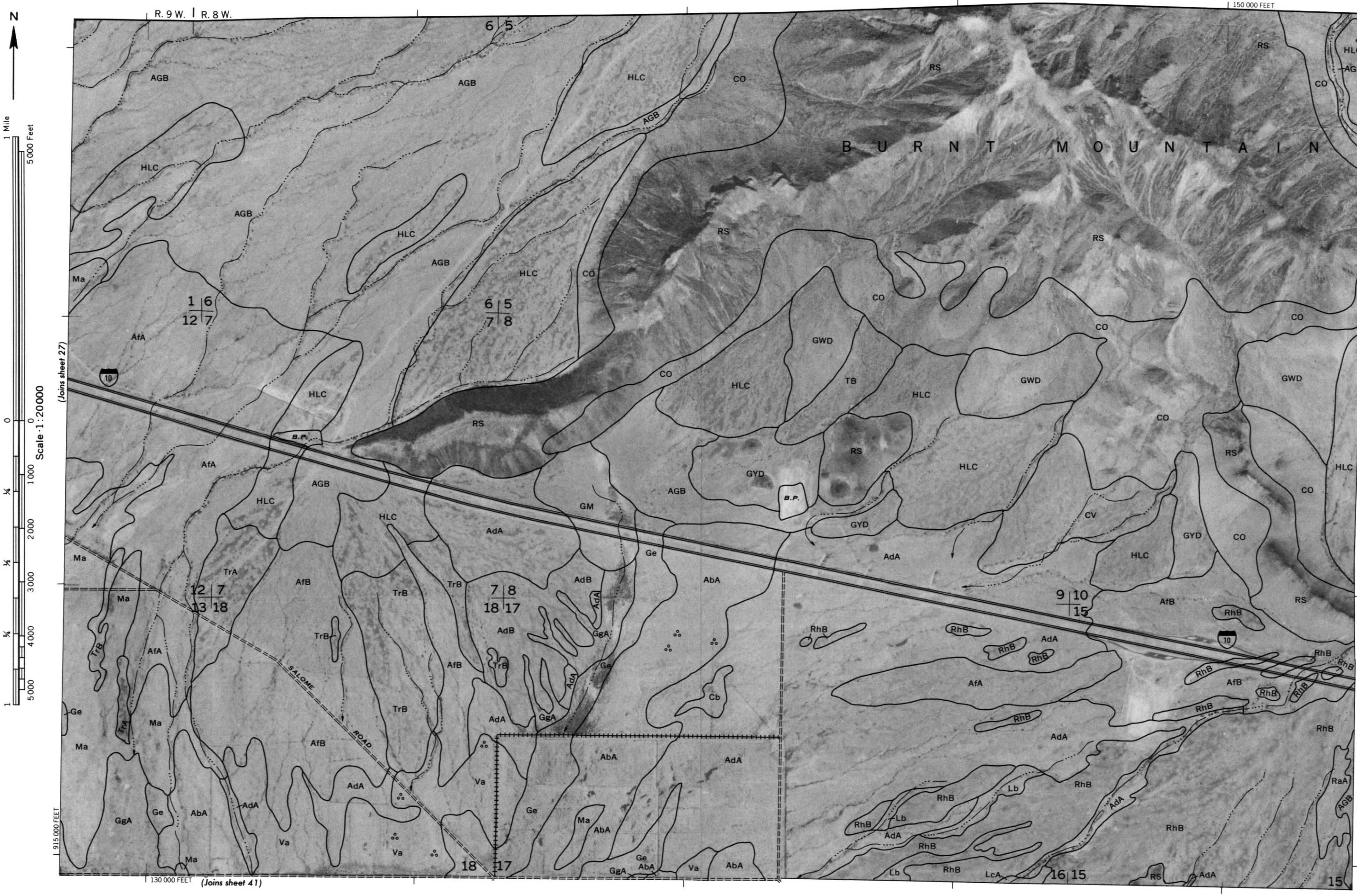
125 000 FEET

N

1 Mile

5000 Feet

Scale 1:20000


N
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
¼
½
¾
1
R. 9 W.
R. 8 W.
T. 2 N.
150 000 FEET
930 000 FEET
915 000 FEET
130 000 FEET
(Joins sheet 27)
(Joins sheet 29)
(Joins sheet 41)
B U R N T M O U N T A I N
SALOME ROAD
10
B.P.
AGB
HLC
CO
RS
GWD
TB
GYD
GM
CV
AfA
AfB
AdA
AdB
AbA
TrA
TrB
Ma
Ge
GgA
Va
Cb
RhB
RaA
Lb
LcA
6 5
1 6
12 7
6 5
7 8
12 7
13 18
7 8
18 17
9 10
15
18 17
16 15
15

N

155 000 FEET

R. 8 W. | R. 7 W.

930 000 FEET

T. 2 N.

TONOPAH DESERT

BORROW PIT

(Joins sheet 28)

(Joins sheet 30)

(Joins sheet 42)

915 000 FEET

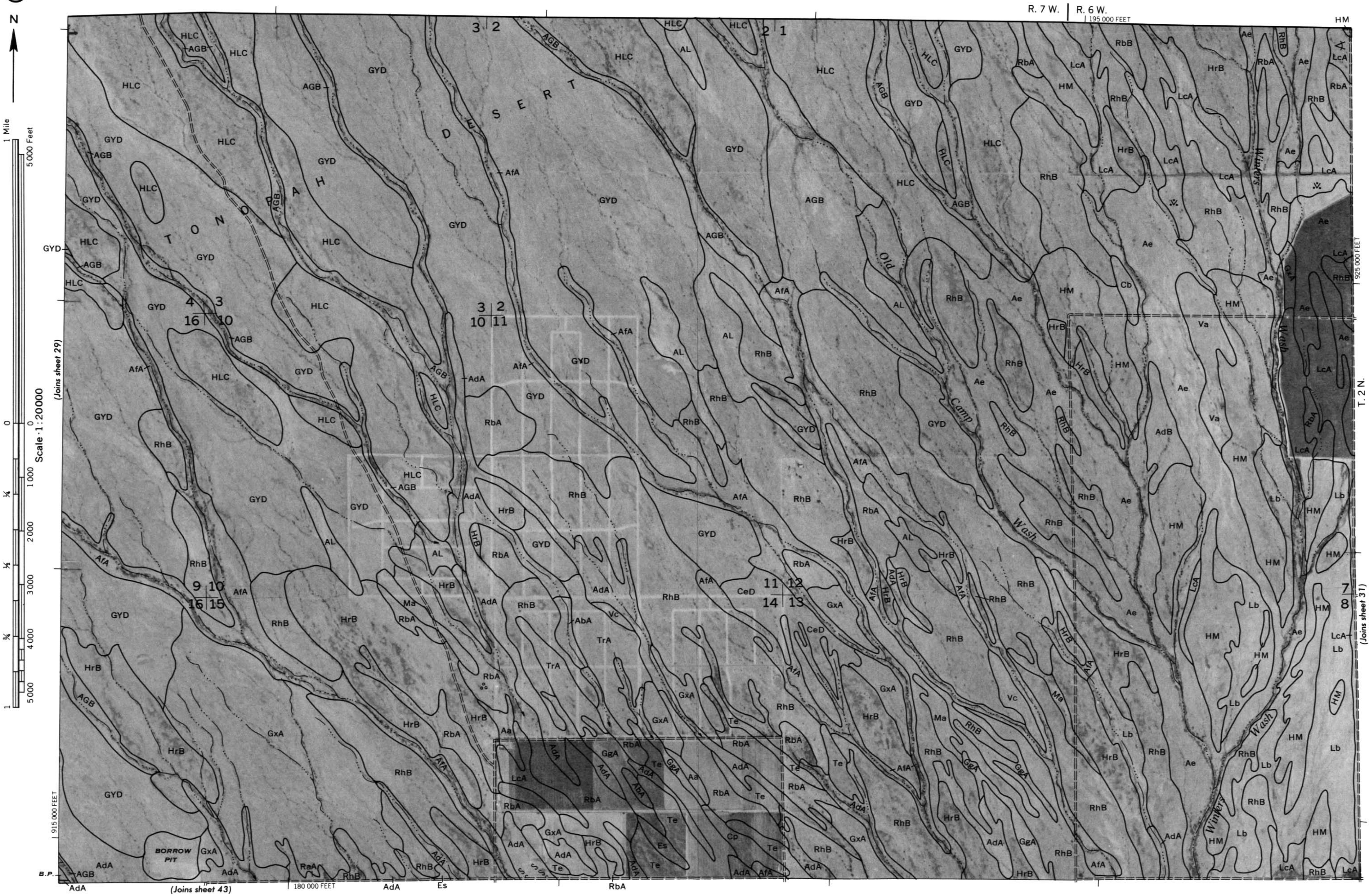
175 000 FEET

1 Mile 5000 Feet

Scale 1:20000

0 0 1000 2000 3000 4000 5000

1 ¼ ½ ¾ 1


N
1 Mile
5000 Feet
Scale 1:20000
R. 7 W.
R. 6 W.
195 000 FEET
925 000 FEET
915 000 FEET
180 000 FEET
T. 2 N.
(Joins sheet 29)
(Joins sheet 31)
(Joins sheet 43)
TONOPAH DESERT
Old Camp Wash
Winters Wash
BORROW PIT
B.P.

200 000 FEET

LIMIT OF SOIL SURVEY

R. 6 W.

T. 2 N.

925 000 FEET

915 000 FEET

(Joins sheet 30)

(Joins inset, sheet 25)

(Joins sheet 44)

220 000 FEET

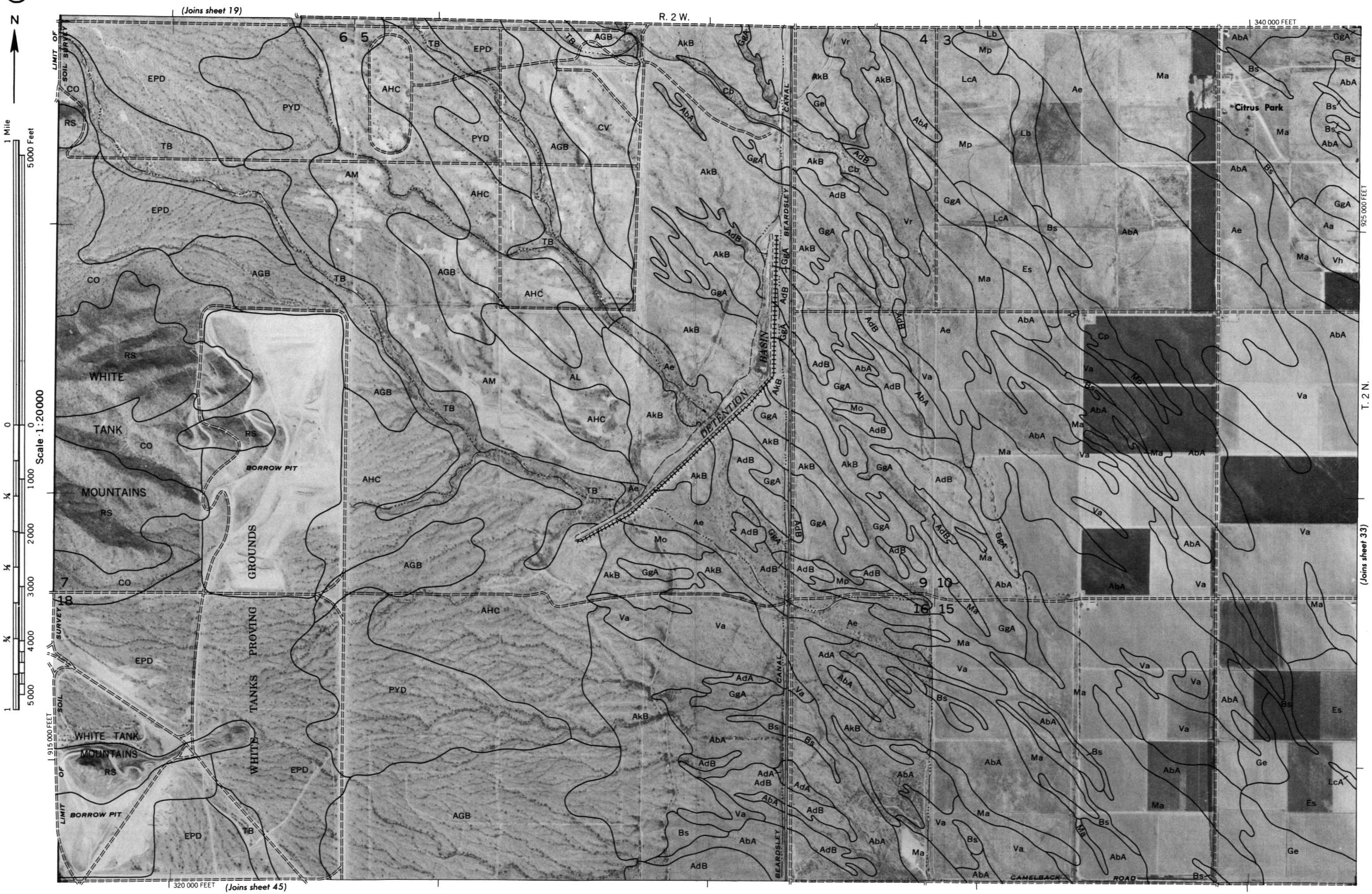
N

1 Mile

5 000 Feet

Scale 1:20000

1 000 2 000 3 000 4 000 5 000


N
(Joins sheet 19)
R. 2 W.
340 000 FEET
925 000 FEET
T. 2 N.
(Joins sheet 33)
(Joins sheet 45)
320 000 FEET
915 000 FEET
1 Mile
5000 Feet
Scale 1:20000
LIMIT OF SOIL SURVEY
WHITE TANK MOUNTAINS
BORROW PIT
WHITE TANKS PROVING GROUNDS
DETENTION BASIN
BEARDSLEY CANAL
Citrus Park
CAMELBACK ROAD


33
N
R. 2 W.
R. 1 W.
T. 2 N.
345 000 FEET
925 000 FEET
915 000 FEET
365 000 FEET
(Joins sheet 20)
(Joins sheet 32)
(Joins sheet 34)
(Joins sheet 46)
CONCRETE LINED
LUKE AIR FORCE BASE
LUKE AIR FORCE BASE
Citrus Park
Sunset Point
SANTA FE
AND
TOPEKA
ATCHISON
CAMELBACK ROAD
LITCHFIELD ROAD
G.P.
Scale 1:20000
1 Mile
5000 Feet
0
1000
2000
3000
4000
5000
¼
½
¾
1

N

1 Mile 5000 Feet

Scale 1:20000

(Joins sheet 21)

R. 1 W. | R. 1 E.

385 000 FEET

925 000 FEET

T. 2 N.

(Joins sheet 33)

(Joins sheet 35)

915 000 FEET

370 000 FEET

(Joins sheet 47)

LUKE AFB

CONCRETE LINED DITCH

GRAVEL PIT

Agua Fria River

NEW RIVER

CANAL

AIRLINE

LITCHFIELD ROAD

CAMELBACK ROAD

DUMP

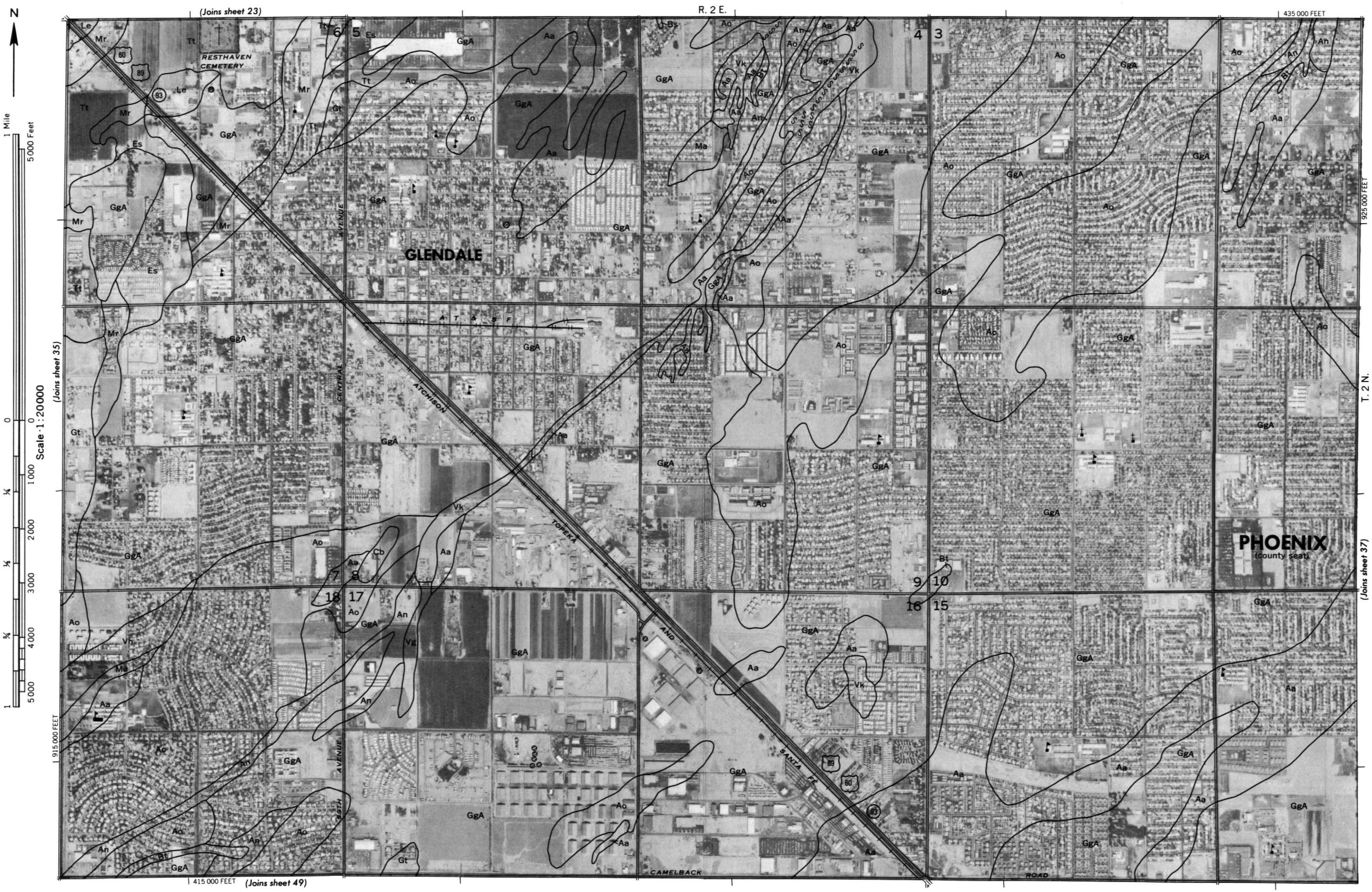
G.P.

water

6 5 7 8 18 17


35
N
390 000 FEET
R. 1 E.
(Joins sheet 22)
925 000 FEET
T. 2 N.
(Joins sheet 34)
(Joins sheet 36)
(Joins sheet 48)
915 000 FEET
410 000 FEET
New River
DUMP
CANAL
83RD AVENUE
GRAND CANAL
CAMELBACK ROAD
int
1 Mile
5000 Feet
Scale 1:20000

MARICOPA COUNTY, ARIZONA, CENTRAL PART — SHEET NUMBER 36



MARICOPA COUNTY, ARIZONA, CENTRAL PART — SHEET NUMBER 37

37

N

R. 2 E. | R. 3 E.

440 000 FEET

925 000 FEET

T. 2 N.

(Joins sheet 24)

(Joins sheet 36)

(Joins sheet 50)

460 000 FEET

915 000 FEET

PHOENIX
(county seat)

WASHINGTON PARK

CAMELBACK ROAD

ARIZONA CANAL

SOIL SURVEY

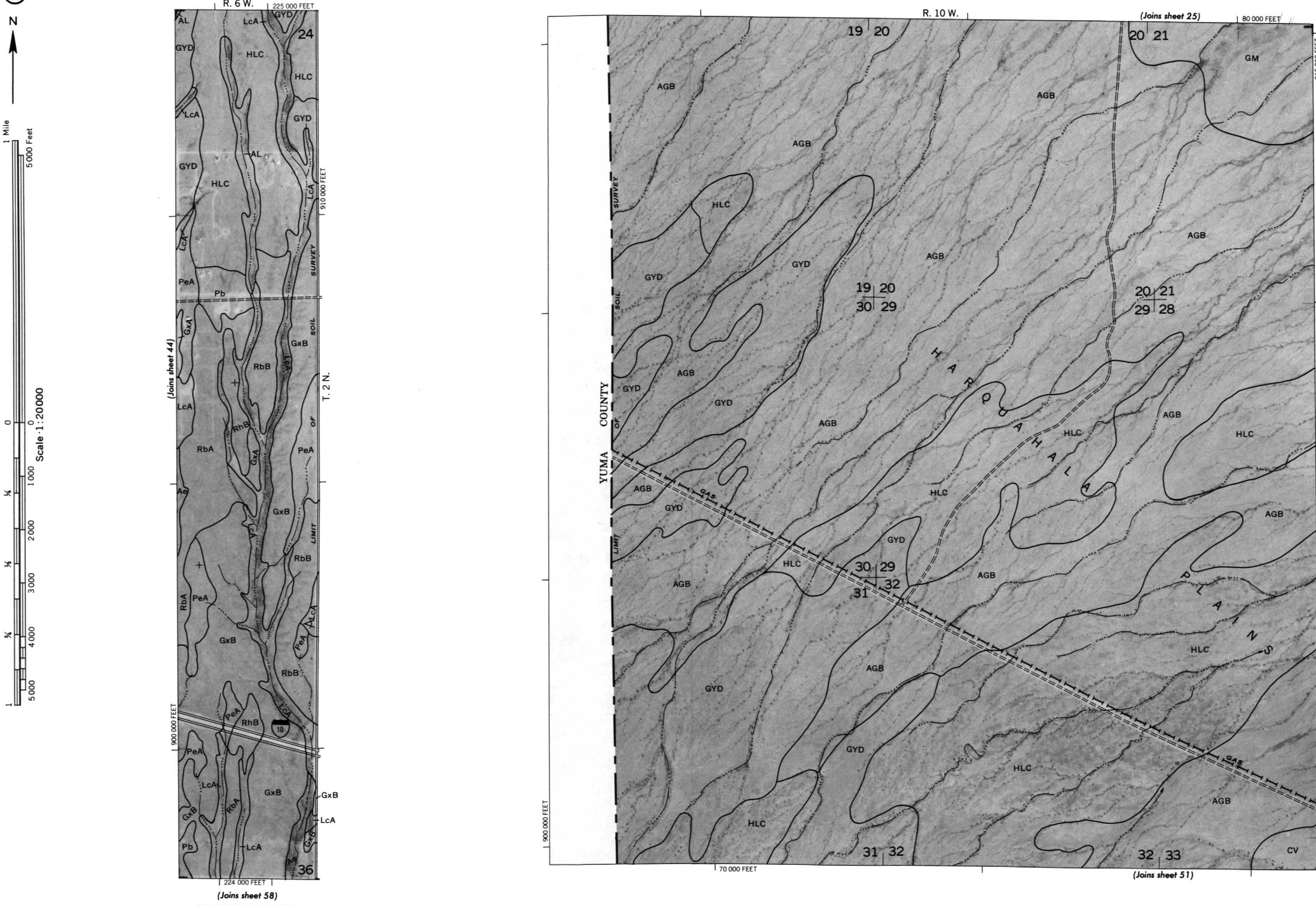
1 Mile

5000 Feet

0

Scale 1:20000

1 000 2000 3000 4000 5000


N
1 Mile
5 000 Feet
0
0
1000
2000
3000
4000
5000
Scale 1:20000
(Joins inset, sheet 25)
R. 6 W.
225 000 FEET
910 000 FEET
900 000 FEET
224 000 FEET
T. 2 N.
(Joins sheet 44)
(Joins sheet 58)
SURVEY
SOIL
OF
LIMIT
24
36
10
AL
LcA
GYD
HLC
PeA
Pb
GxA
GxB
RbB
RhB
RbA
Ae
1000 AND 5000-FOOT GRID TICKS
R. 10 W.
(Joins sheet 25)
80 000 FEET
915 000 FEET
70 000 FEET
900 000 FEET
(Joins sheet 51)
(Joins sheet 39)
T. 2 N.
YUMA COUNTY
SURVEY
SOIL
OF
LIMIT
GAS
H A R Q U A H A L A
P L A I N S
19 20
20 21
19 20 30 29
20 21 29 28
30 29 31 32
31 32
32 33
AGB
GYD
HLC
GM
CV

N

85 000 FEET

915 000 FEET

R. 10 W. | R. 9 W.

(Joins sheet 26)

T. 2 N.

(Joins sheet 38)

(Joins sheet 40)

900 000 FEET

100 000 FEET

(Joins sheet 52)

Centennial Wash

Tiger Wash

Allison Tank

HARQUAHALA PLAINS

GAS

Scale 1:20000

1 Mile 5 000 Feet

N

R. 9 W.

T. 2 N.

125 000 FEET

910 000 FEET

900 000 FEET

105 000 FEET

Scale · 1 : 20000

1 Mile

5000 Feet

0

1000

2000

3000

4000

5000

(Joins sheet 27)

(Joins sheet 39)

(Joins sheet 41)

(Joins sheet 53)

Tiger Wash

20 21 28 29 32 33 34 35 36 23 24 25 26 27

AbA Aa Ac Bs Bt Ch Cm Dn Es Et Ge GgA Gh Gr Gf LcA Ld Ma Tu Va Vb Vh

R. 9 W. | R. 8 W.

130 000 FEET

910 000 FEET

T. 2 N.

(Joins sheet 28)

(Joins sheet 40)

(Joins sheet 42)

(Joins sheet 54)

150 000 FEET

900 000 FEET

N

1 Mile

5000 Feet

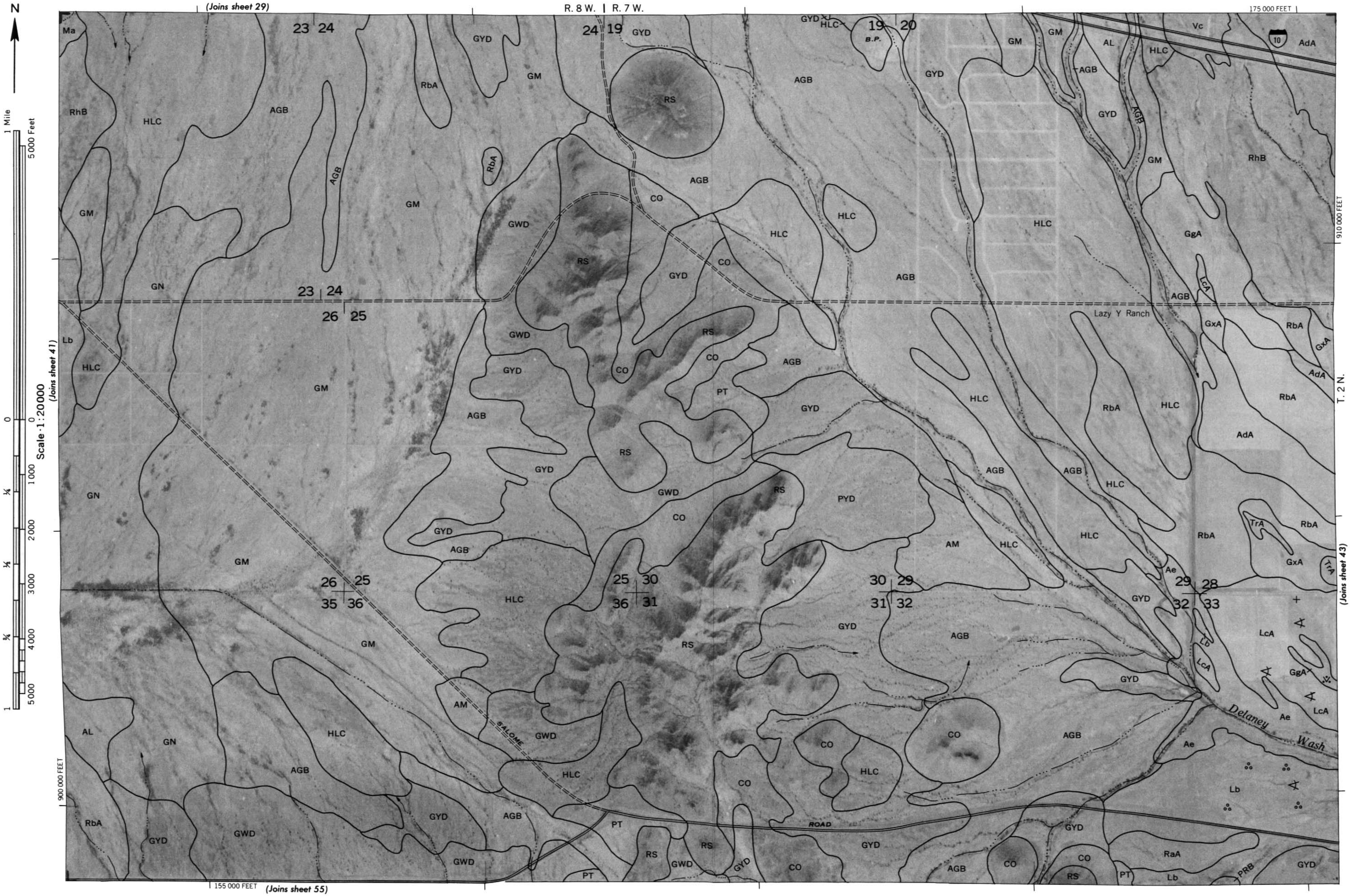
Scale 1:20000

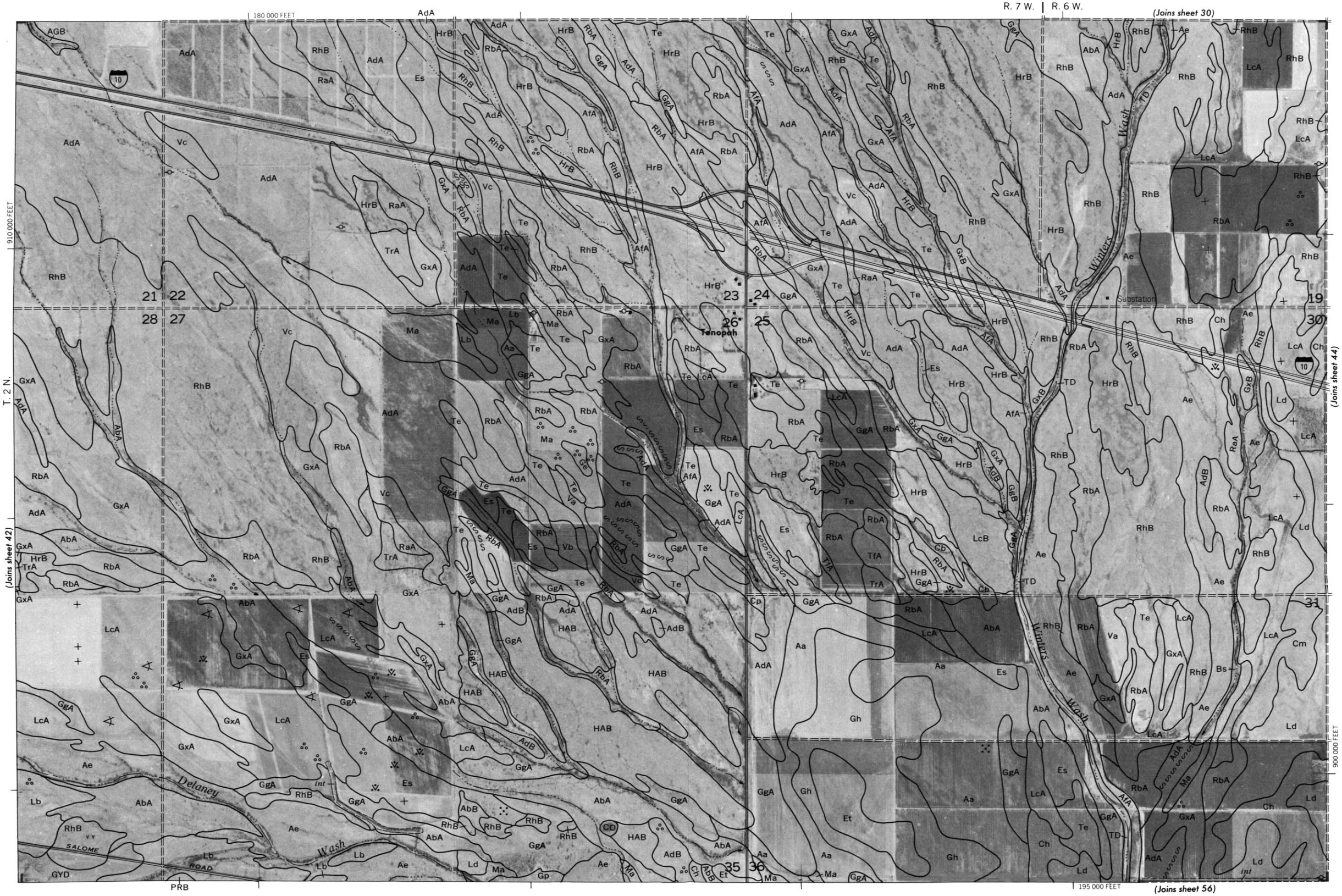
1 0 0 1000 2000 3000 4000 5000

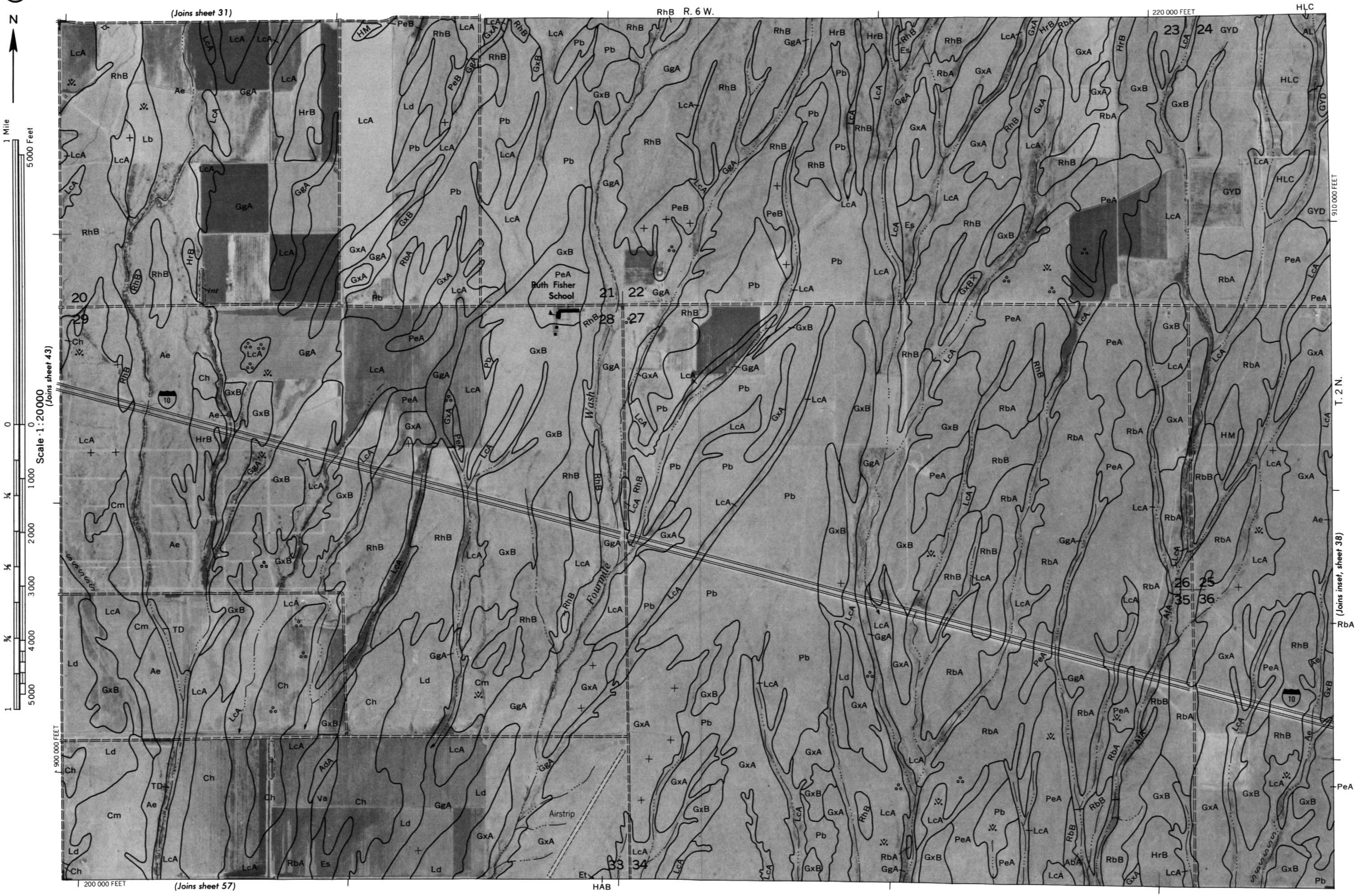
SALOME ROAD

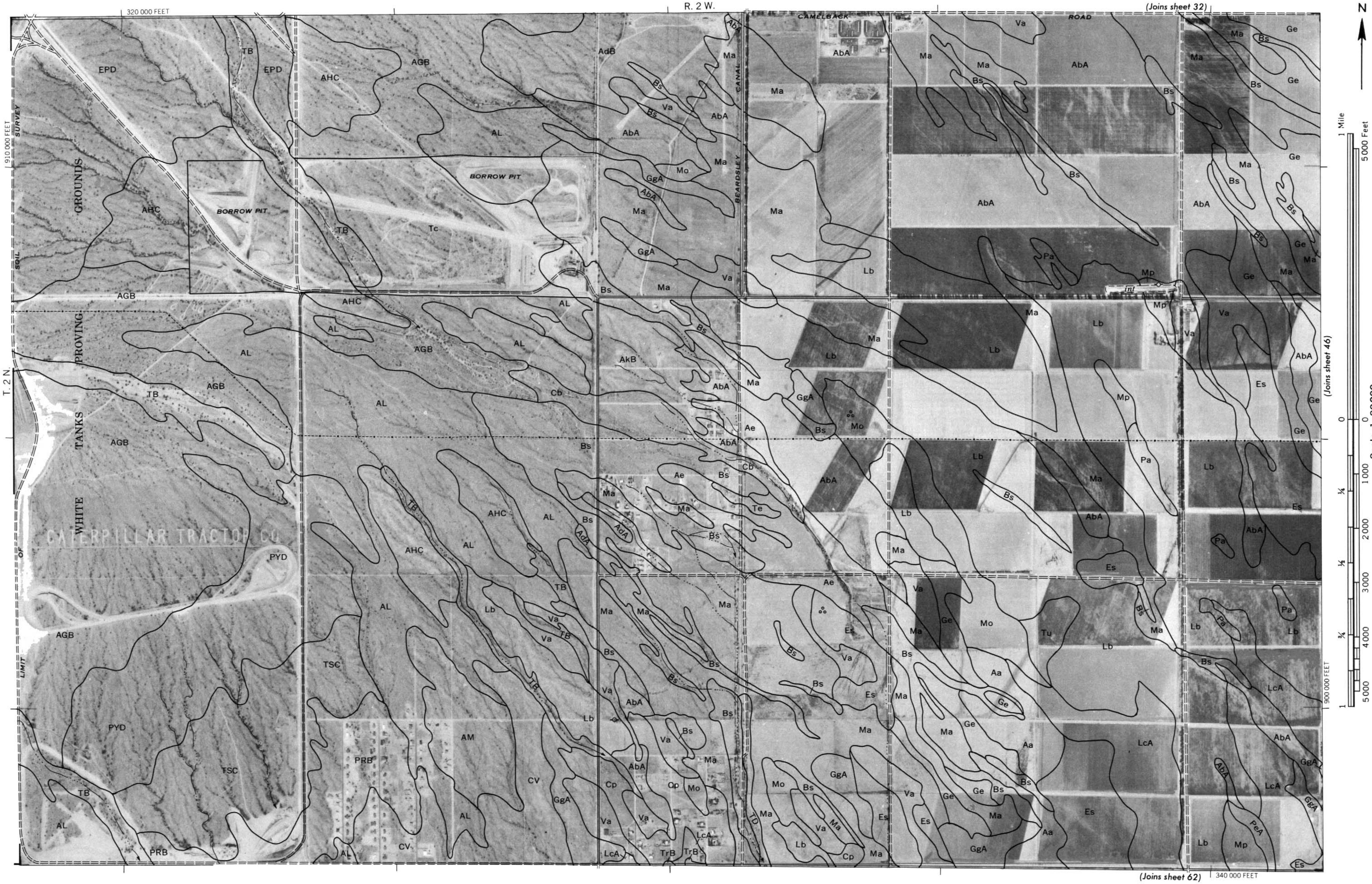
19 20 28 27 33 34

Et Es Ch Tu Et GgA Es Ch Tu Lb GWD

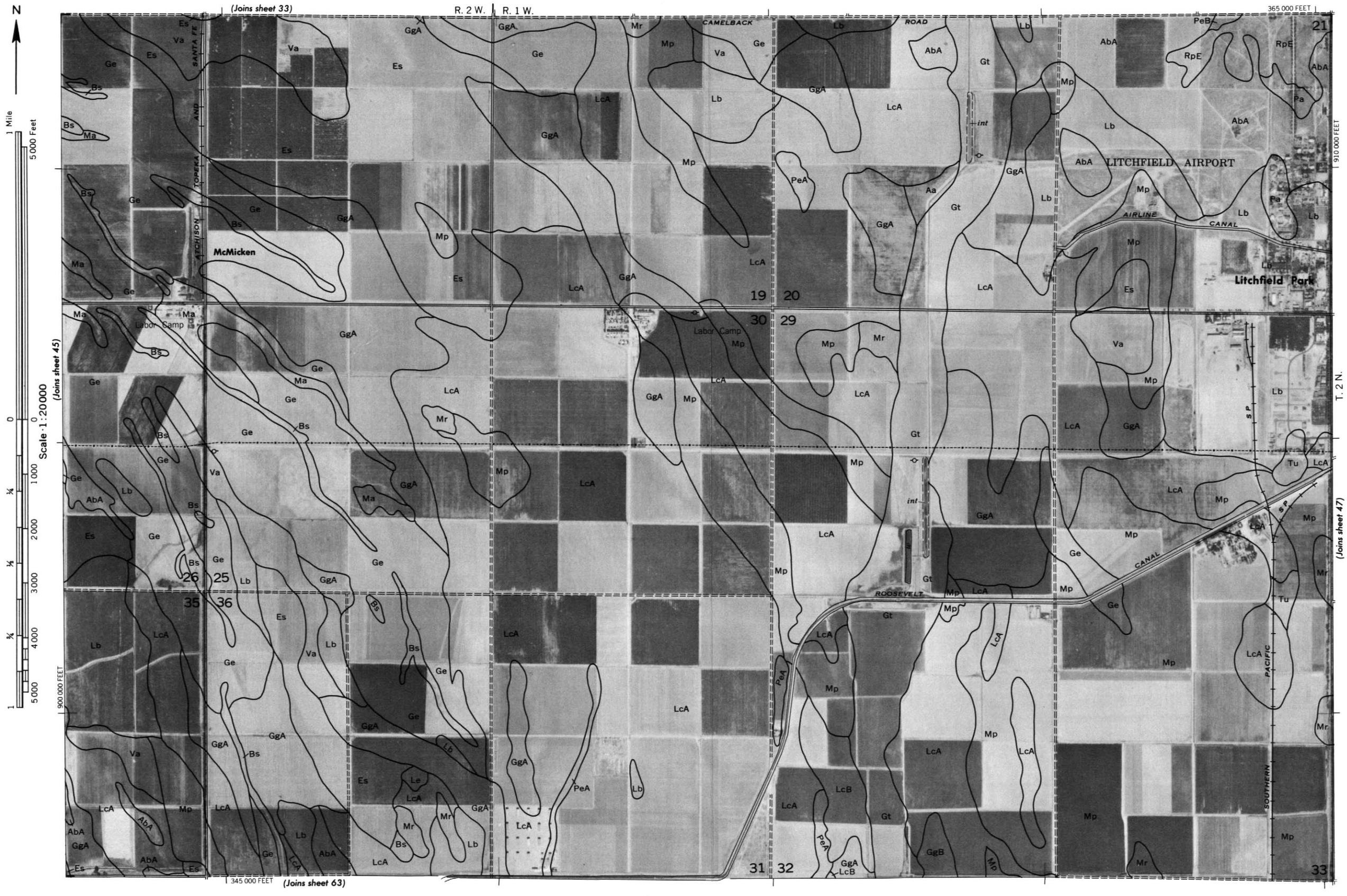

N
1 Mile
5 000 Feet
Scale 1:20 000
(Joins sheet 29)
(Joins sheet 41)
(Joins sheet 43)
(Joins sheet 55)
R. 8 W. | R. 7 W.
T. 2 N.
175 000 FEET
910 000 FEET
900 000 FEET
155 000 FEET
10
Lazy Y Ranch
Delaney Wash
SALOME ROAD
B.P.


180 000 FEET
910 000 FEET
900 000 FEET
195 000 FEET
R. 7 W.
R. 6 W.
T. 2 N.
(Joins sheet 30)
(Joins sheet 42)
(Joins sheet 44)
(Joins sheet 56)
Tenopah
Substation
Wash
Winters
Delaney
SALOME ROAD
PRB
GYD
N
1 Mile
5000 Feet
Scale 1:20000


N
1 Mile
5 000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
(Joins sheet 31)
(Joins sheet 43)
(Joins sheet 57)
(Joins inset, sheet 38)
R. 6 W.
T. 2 N.
220 000 FEET
910 000 FEET
200 000 FEET
900 000 FEET
Ruth Fisher School
Fourmile Wash
Airstrip
10
20
21
22
23
24
25
26
27
28
29
33
34
35
36



320 000 FEET
R. 2 W.
(Joins sheet 32)
CAMELBACK
ROAD
CANAL
BEARDSLEY
BORROW PIT
BORROW PIT
910 000 FEET
SOIL SURVEY
GROUNDS
PROVING
TANKS
WHITE
OF
LIMIT
T. 2 N.
CATERPILLAR TRACTOR CO
(Joins sheet 46)
900 000 FEET
(Joins sheet 62)
340 000 FEET
N
1 Mile
5000 Feet
Scale 1:20000


N
1 Mile
5000 Feet
0
Scale · 1:20000
(Joins sheet 45)
(Joins sheet 33)
R. 2 W.
R. 1 W.
365 000 FEET
910 000 FEET
900 000 FEET
345 000 FEET
(Joins sheet 63)
(Joins sheet 47)
T. 2 N.
SANTA FE, TOPEKA AND ATCHISON
CAMELBACK ROAD
ROOSEVELT CANAL
AIRLINE CANAL
SOUTHERN PACIFIC
LITCHFIELD AIRPORT
McMicken
Litchfield Park
Labor Camp
int
19
20
21
29
30
31
32
33
25
26
35
36

MARICOPA COUNTY, ARIZONA, CENTRAL PART — SHEET NUMBER 47

47

N

R. 1 W. | R. 1 E.

T. 2 N.

370 000 FEET

910 000 FEET

900 000 FEET

385 000 FEET

(Joins sheet 34)

(Joins sheet 46)

(Joins sheet 48)

(Joins sheet 64)

Litchfield Park

Wigwam Country Club

LITCHFIELD CEMETERY

CAMELBACK ROAD

ROOSEVELT

CANAL

AIRLINE

G.P.

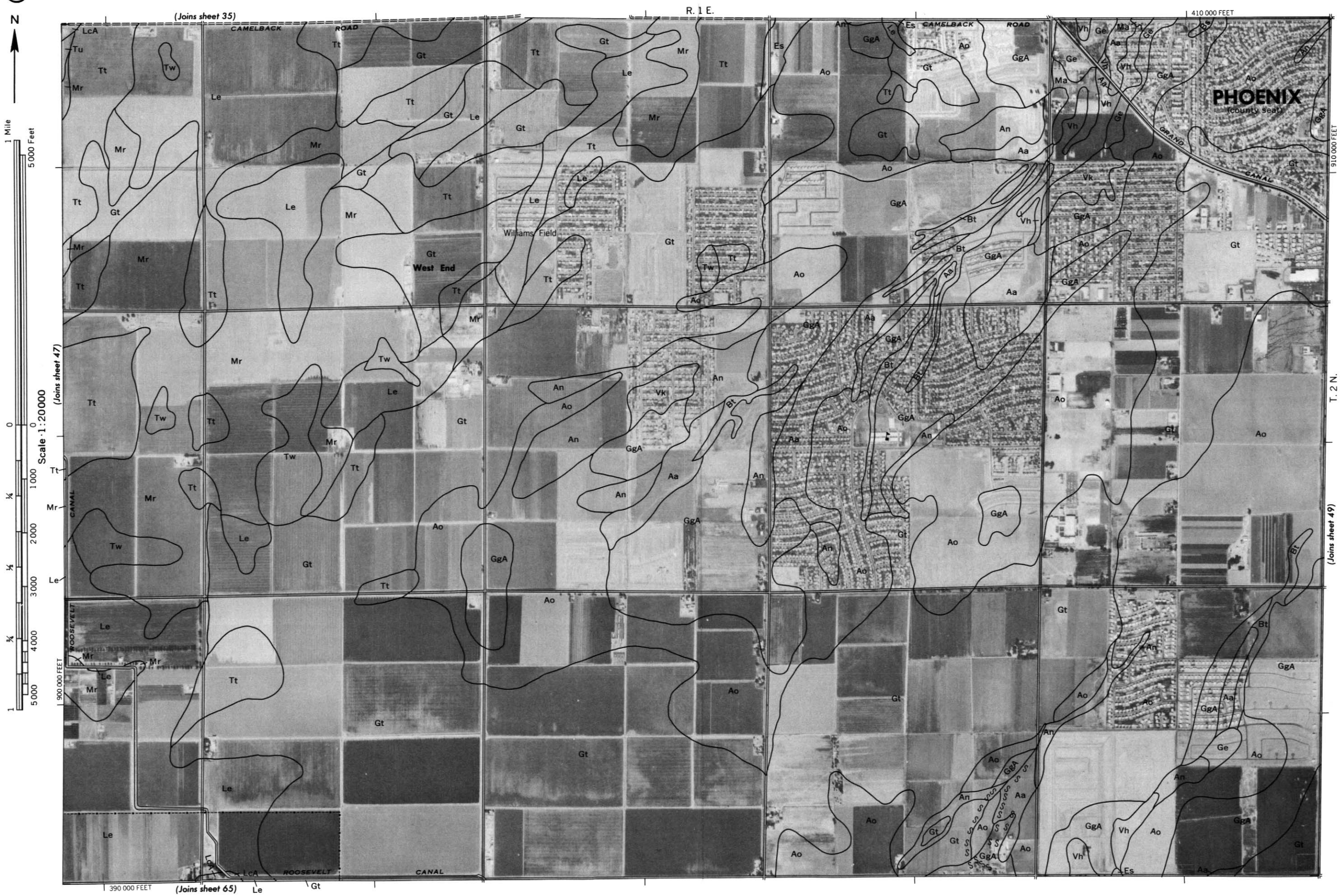
New River

Agua Fria

1 Mile

5000 Feet

Scale 1:20000


N
1 Mile
5000 Feet
Scale · 1:20000
(Joins sheet 35)
(Joins sheet 47)
(Joins sheet 65)
(Joins sheet 49)
R. 1 E.
T. 2 N.
410 000 FEET
910 000 FEET
900 000 FEET
390 000 FEET
CAMELBACK ROAD
PHOENIX
(county seat)
GRAND CANAL
Williams Field
West End
CANAL
ROOSEVELT
LcA Tu Tt Tw Mr Le Gt Ge Ma Vh Aa Es An Ao GgA Bt Vk Aa

415 000 FEET

R. 2 E.

(Joins sheet 36)

910 000 FEET

T. 2 N.

CAMELBACK ROAD

Maryvale

AVENUE

WATER TANK

GRAND CANAL

PHOENIX
(county seat)

Alhambra

ATCHISON TOPEKA AND SANTA FE

A T & S F

Cartwright

BORROW PIT

(Joins sheet 48)

(Joins sheet 50)

(Joins sheet 66)

900 000 FEET

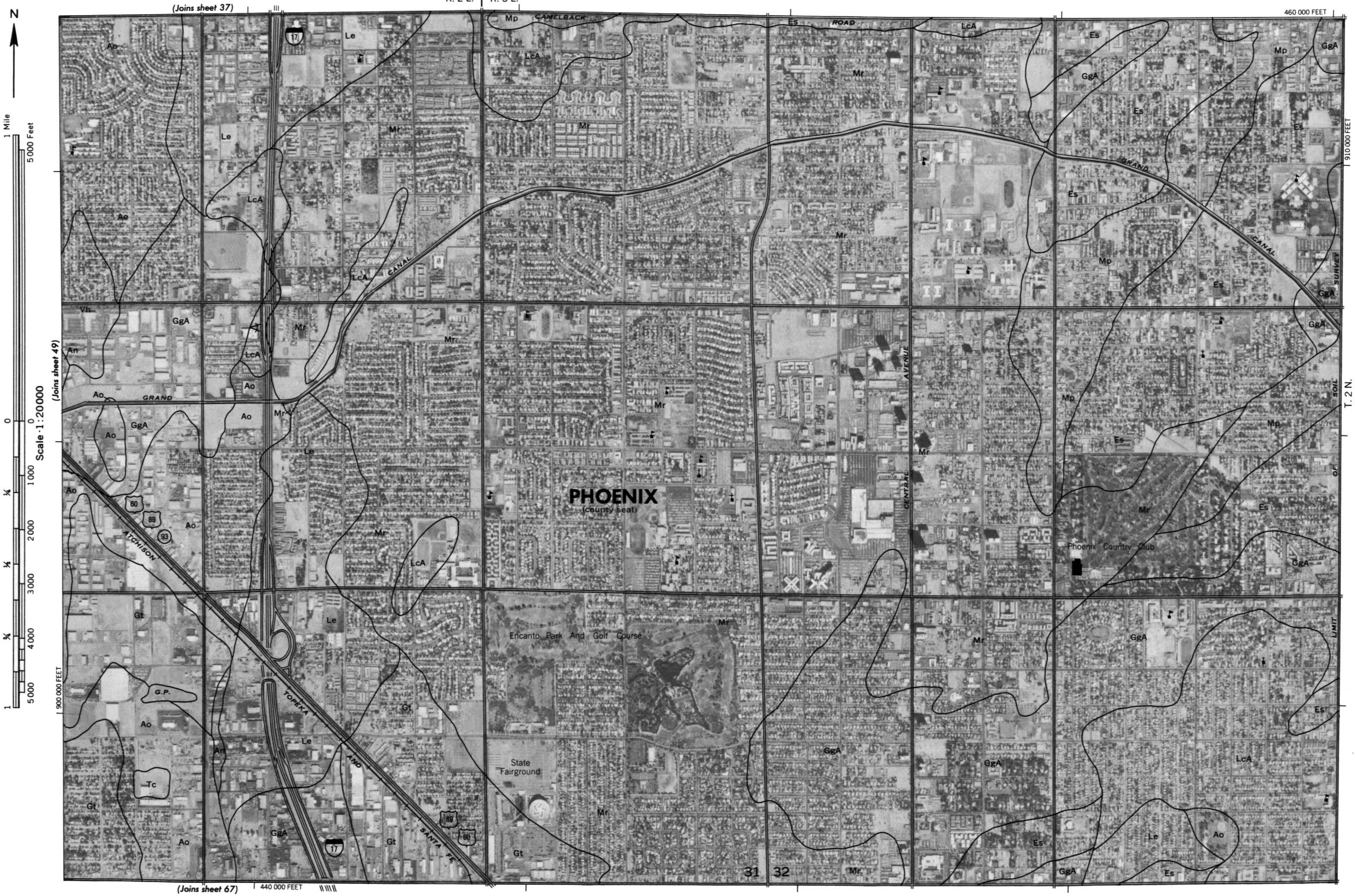
435 000 FEET

N

1 Mile 5000 Feet 0 0

Scale 1:20000

1 5000 ¾ 4000 ½ 3000 ¼ 2000 1000


N
1 Mile
5 000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
R. 2 E.
R. 3 E.
(Joins sheet 37)
(Joins sheet 49)
(Joins sheet 67)
460 000 FEET
910 000 FEET
900 000 FEET
440 000 FEET
T. 2 N.
CAMELBACK
ROAD
GRAND
CANAL
CENTRAL
AVENUE
PHOENIX
(county seat)
Encanto Park And Golf Course
State
Fairground
Phoenix Country Club
ATCHISON
TOPEKA
AND
SANTA FE
SOIL SURVEY LIMIT
17
60
89
93
31
32
Ao
Mp
Le
LcA
Mr
Es
GgA
Vh
An
Gt
G.P.
Tc
Ar

N

60 000 FEET

895 000 FEET

R. 10 W.

6 5

5 4

(Joins sheet 38)

T. 1 N.

SOIL SURVEY

YUMA COUNTY LIMIT OF

HLC
GYD
CO
RS
AGB
CV
TB
GWD

GRANITE MOUNTAIN

EAGLETAIL MOUNTAINS

(Joins sheet 52)

(Joins sheet 68)

885 000 FEET

80 000 FEET

1 Mile
5000 Feet
0
0
Scale 1:20000
1
¼
½
¾
1
1000
2000
3000
4000
5000

N

1 Mile 5 000 Feet

Scale 1:20000

(Joins sheet 39)

(Joins sheet 51)

(Joins sheet 69)

(Joins sheet 53)

R. 10 W. | R. 9 W.

100 000 FEET

85 000 FEET

885 000 FEET

895 000 FEET

T. 1 N.

HARQUAHALA

GAS

HARQUAHALA PLAINS

GAS

INT

GRANITE MOUNTAIN

RS

TB

Airstrip

4 | 3
9 | 10

3 | 2
10 | 11

14 | 13

CV GM GYD RS CO AL AM AGB AHC HLC TfA Ma AbA AdA Va Ge Mo Cp GgA Lb Gr Ld LcA Es Tu GxA Th Ae PeA TrA Tg

MARICOPA COUNTY, ARIZONA, CENTRAL PART — SHEET NUMBER 53

53

105 000 FEET

R. 9 W.

(Joins sheet 40)

895 000 FEET

T. 1 N.

(Joins sheet 52)

(Joins sheet 54)

885 000 FEET

(Joins sheet 70)

125 000 FEET

N

1 Mile

5000 Feet

Scale 1:20000

Centennial Wash

Harquahala Valley School

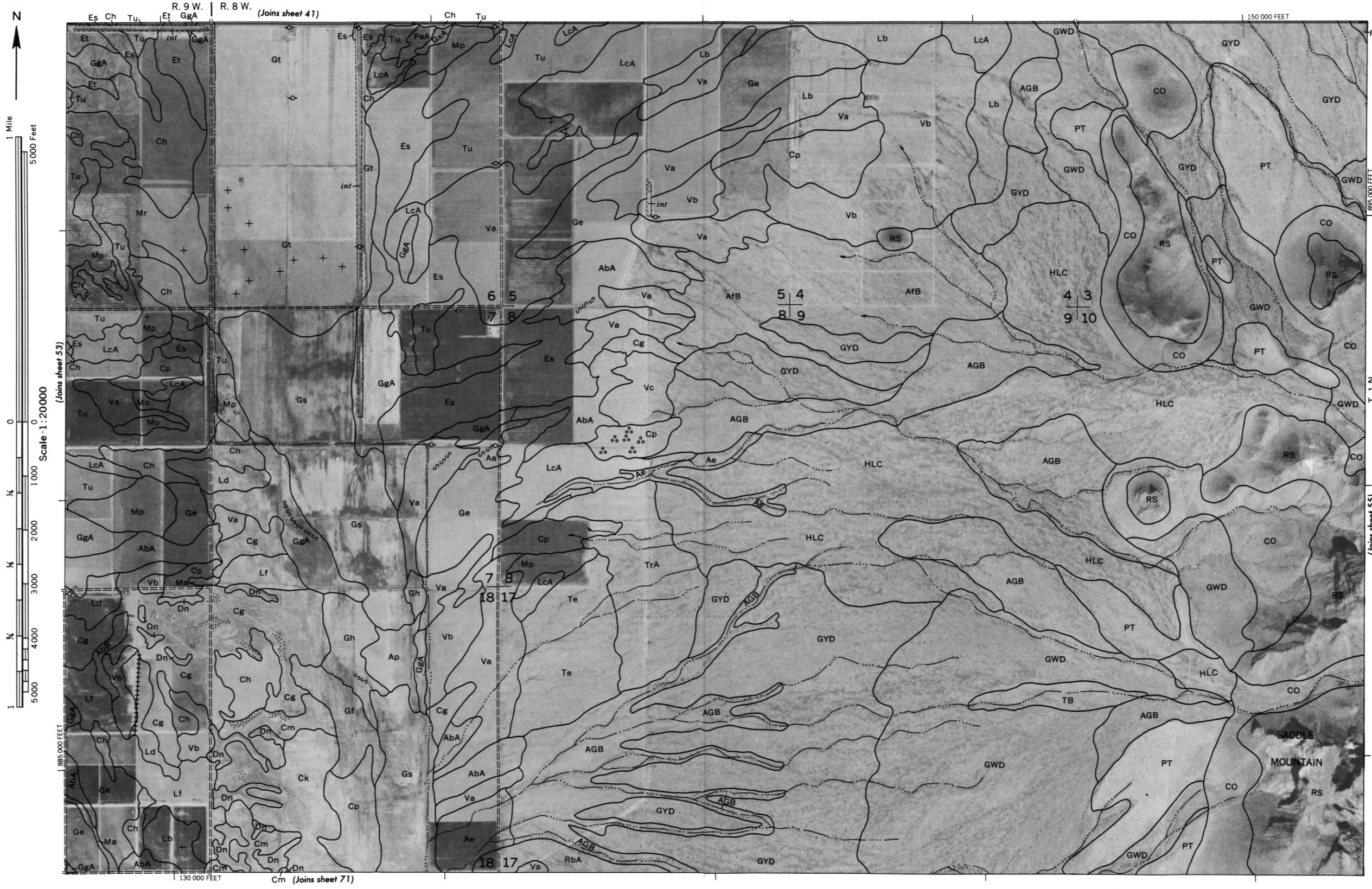
Desert-Ho Ranch

VAN BUREN STREET

Airstrip

HARQUAHALA PLAINS

GAS


N
R. 9 W.
R. 8 W.
(Joins sheet 41)
150 000 FEET
RbA
GWD
GYD
CO
PT
RS
HLC
AGB
Lb
LcA
Va
Vb
Ge
Cp
AbA
AfB
Tu
Es
Ch
Et
GgA
Gt
Mp
Mr
Mo
Gs
Ld
Lf
Dn
Cg
Gh
Ap
Cm
Ck
Gf
Vc
Ae
TrA
Te
TB
SADDLE MOUNTAIN
1 Mile
5 000 Feet
Scale · 1:20000
(Joins sheet 53)
895 000 FEET
885 000 FEET
T. 1 N.
(Joins sheet 55)
130 000 FEET
(Joins sheet 71)

MARICOPA COUNTY, ARIZONA, CENTRAL PART — SHEET NUMBER 55

55

N

155 000 FEET

R. 8 W. | R. 7 W.

(Joins sheet 42)

T. 1 N.

895 000 FEET

885 000 FEET

175 000 FEET

(Joins sheet 54)

(Joins sheet 56)

(Joins sheet 72)

M O U N T A I N

S A D D L E

1 Mile

5 000 Feet

Scale 1:20000

RbA GYD GWD PT AGB RS CO PYD Lb PRB TB HLC

1 6 / 12 7

6 5 / 7 8

12 7 / 13 18

8 9 / 17 16

13 18


N
(Joins sheet 43)
(Joins sheet 55)
(Joins sheet 57)
(Joins sheet 73)
R. 7 W.
R. 6 W.
T. 1 N.
195 000 FEET
895 000 FEET
885 000 FEET
180 000 FEET
1 Mile
5 000 Feet
Scale 1:20000
Delaney Wash
SALOME ROAD
Winters Wash
TD Wash
P A L O V E R D E
H I L L S

200 000 FEET

R. 6 W.

(Joins sheet 44)

N

895 000 FEET

T. 1 N.

(Joins sheet 56)

(Joins sheet 58)

1 Mile

5 000 Feet

Scale 1:20000

885 000 FEET

(Joins sheet 74)

220 000 FEET


(Joins inset, sheet 38)
R. 6 W.
R. 5 W.
245 000 FEET
895 000 FEET
T. 1 N.
INTERSTATE HIGHWAY NO 10
UNDER CONSTRUCTION
BUCKEYE FLOODWATER RETARDATION STRUCTURE
intermittent
VAN BUREN ROAD
Wash
Dickey
Phillips
HASSAYAMPA RIVER
4 3
7 8
18 17
9 10
16 15
N
1 Mile
5000 Feet
Scale 1:20000
(Joins sheet 57)
885 000 FEET
225 000 FEET
(Joins sheet 75)
(Joins sheet 59)

250 000 FEET

R. 5 W. | R. 4 W.

T. 1 N.

895 000 FEET

885 000 FEET

270 000 FEET

N

1 Mile

5000 Feet

Scale 1:20000

(Joins sheet 58)

(Joins sheet 60)

(Joins sheet 76)

LIMIT OF SOIL SURVEY

INTERSTATE BUCKEYE FLOODWATER RETARDATION STRUCTURE HIGHWAY NO 10

UNDER CONSTRUCTION

VAN BUREN STREET

LUKE AUXILIARY NO 5 FIELD

intermittent

1 6
2 11
11 12
14 13
6 5

GWD GYD PRB HLC AGB GM AL CV AM PT GN Ma AdA GgA PeA Lb RpE aA AbA RaA Pa Cp CrB

N

Scale · 1:20000

1 Mile 5000 Feet

R. 4 W. | R. 3 W.

290 000 FEET

895 000 FEET

885 000 FEET

275 000 FEET

T. 1 N.

LIMIT OF SOIL SURVEY

4 | 3

9 | 10
16 | 15

10 | 11
15 | 14

7
18

INTERSTATE BUCKEYE HIGHWAY FLOODWATER RETARDATION STRUCTURE

CONSTRUCTION UNDER NO IO

intermittent

AM AL GYD AGB CO PT PYD TSC GWD HLC RS PWB AbA CV Cp PRB Ae Lb

(Joins sheet 59)

(Joins sheet 61)

(Joins sheet 77)

295 000 FEET

R. 3 W.

N

895 000 FEET

T. 1 N.

(Joins sheet 60)

(Joins sheet 62)

(Joins sheet 78)

315 000 FEET

885 000 FEET

1 Mile

5000 Feet

Scale 1:20000

0 0 ¼ 1000 ½ 2000 ¾ 3000 1 4000 5000

RETARDATION STRUCTURE

FLOODWATER

Intermittent

BUCKEYE

INTERSTATE

HIGHWAY

CONSTRUCTION

UNDER

NO 10

NO 6

LUKE AIR FORCE AUXILIARY FIELD

CANAL

ROOSEVELT

RS PYD CO TSC GYD TB AGB HLC CV AL Cp PRB AdA Vh Cb AbA Pa RaA Ma LcA PeA

N

R. 3 W. | R. 2 W.

(Joins sheet 45)

340 000 FEET

895 000 FEET

T. 1 N.

(Joins sheet 61)

885 000 FEET

320 000 FEET (Joins sheet 79)

(Joins sheet 63)

1 Mile 5000 Feet

Scale 1:20000

0 0

1000 2000 3000 4000 5000

DETENTION BASIN

WHITE TANK DAM

LUKE AIR FORCE AUXILIARY FIELD NO 6

CANAL

ROOSEVELT

Perryville

9 10 16 15

AL CV PRB TB HLC Cp AbA Ma LcA Va TrB GgA PeA Aa Lb Es Bs Mo Mr TD Ge Mp RbA CrB PeB LcB Bs Pa int


63
N
R. 2 W.
R. 1 W.
345 000 FEET
895 000 FEET
(Joins sheet 46)
(Joins sheet 64)
(Joins sheet 62)
(Joins sheet 80)
885 000 FEET
365 000 FEET
T. 1 N.
ROOSEVELT
CANAL
VAN BUREN
STREET
PACIFIC
SOUTHERN
Estrella Camp
PHOENIX-LITCHFIELD
MUNICIPAL AIRPORT
Litchfield Junction
GAS
S P
80
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
¼
½
¾
1

(Joins sheet 47)

R. 1 W. | R. 1 E.

385 000 FEET

895 000 FEET

T. 1 N.

(Joins sheet 63)

(Joins sheet 65)

885 000 FEET

370 000 FEET

(Joins sheet 81)

N

1 Mile

5000 Feet

0

0

Scale 1:20000

1000

2000

3000

4000

5000

1

GOODYEAR

AVONDALE

Litchfield

CASHION

Littleton School

VAN BUREN STREET

PACIFIC

SOUTHERN PACIFIC

GAS

SOUTHERN CENTRAL AVENUE

Agua Fria River

Aqua Fria River

80

390 000 FEET

R. 1 E.

(Joins sheet 48)

895 000 FEET

T. 1 N.

(Joins sheet 64)

(Joins sheet 66)

885 000 FEET

(Joins sheet 82)

410 000 FEET

N

1 Mile 5000 Feet

Scale 1:20000

0 0 1000 2000 3000 4000 5000

¼ ⅛ ¾ 1

4 3 2 1

BORROW PIT

AVENUE

VAN BUREN STREET

ROOSEVELT CANAL

PACIFIC SOUTHERN

83RD

TOLLESON

Santa Maria

80

Tw Le Mp LcA Gt Vf Tt Mr Ao GgA Aa Vh Es Ge Gr Tu Lb Tg

N

1 Mile 5000 Feet

0 0

Scale 1:20000

1 000 2000 3000 4000 5000

¼ ½ ¾ 1

(Joins sheet 49)

R. 2 E.

435 000 FEET

895 000 FEET

T. 1 N.

(Joins sheet 65)

885 000 FEET

415 000 FEET (Joins sheet 83)

(Joins sheet 67)

PHOENIX
(county seat)

Fowler

AVENUE

VAN BUREN

PACIFIC

SOUTHERN

STREET

SP

INDUSTRIAL PLANT

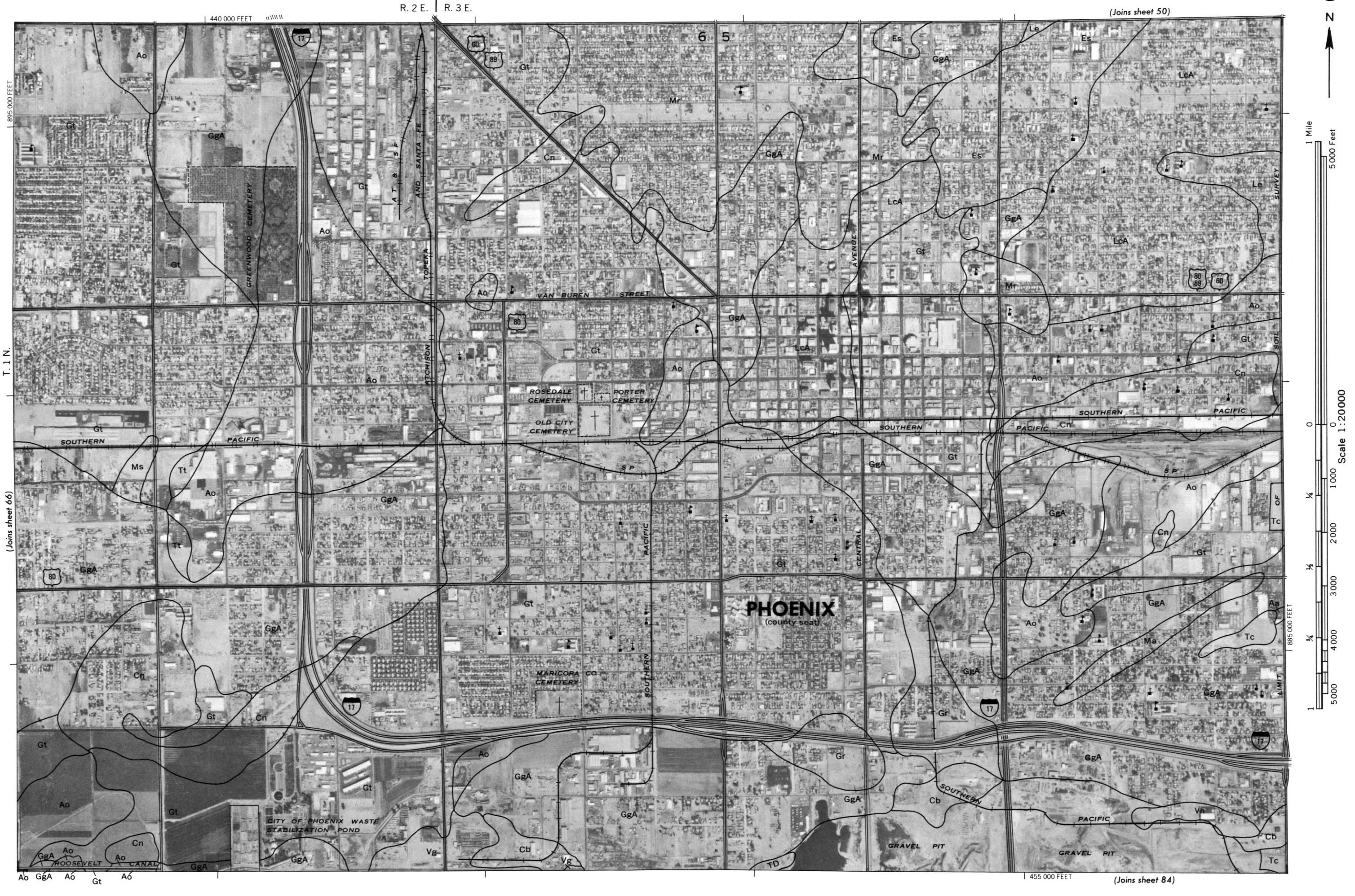
WATER

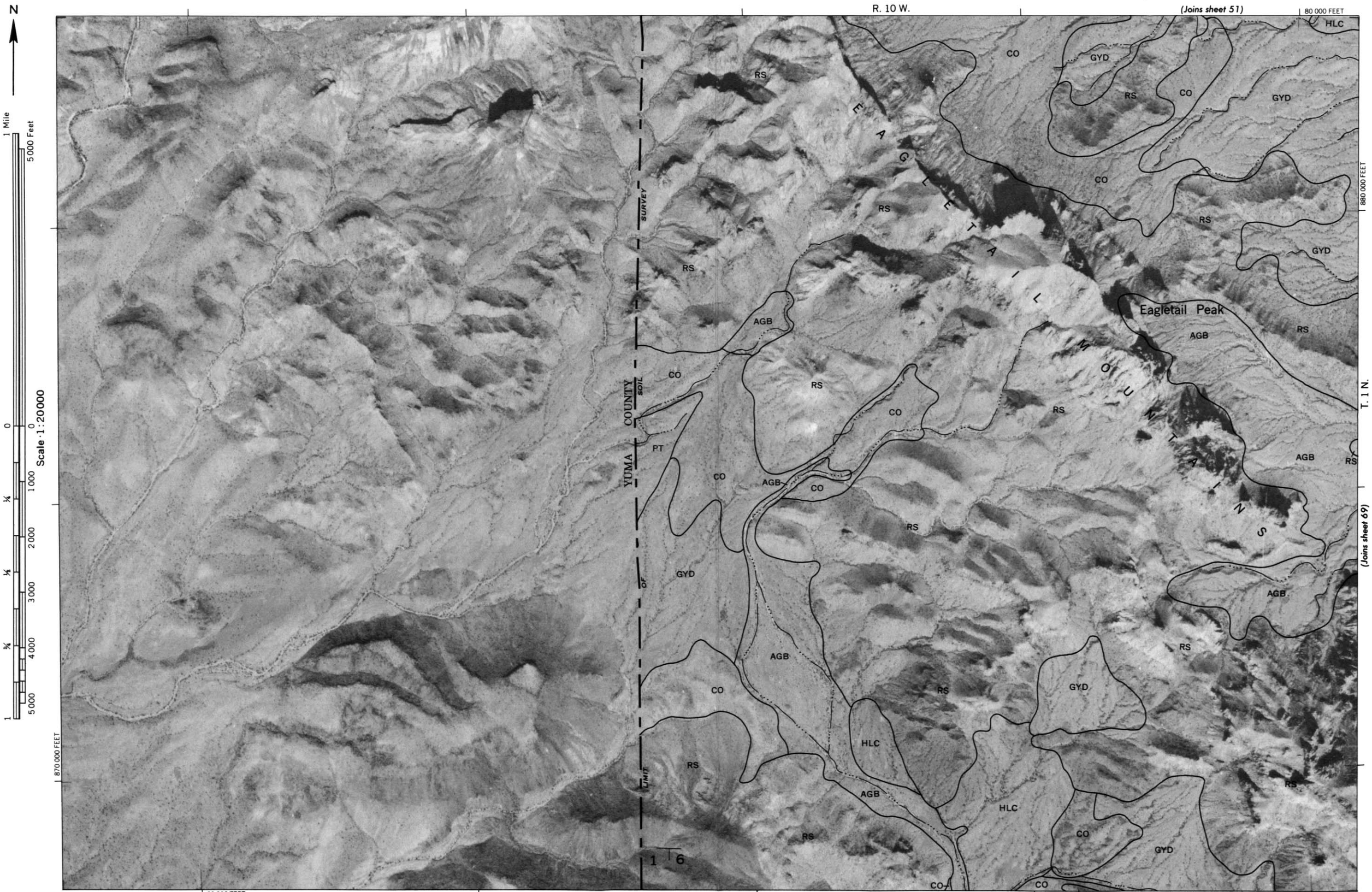
59TH

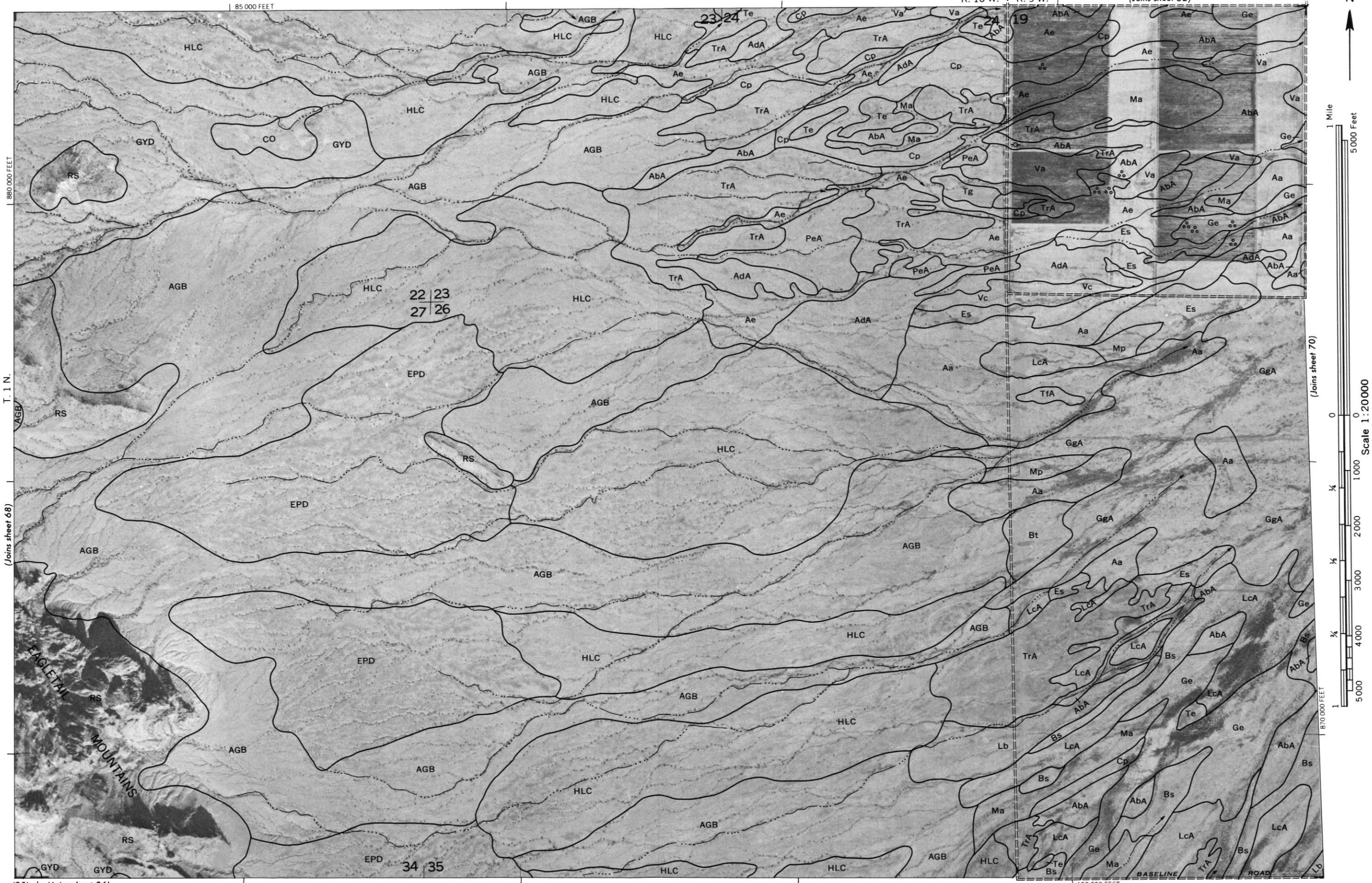
ROOSEVELT

CANAL

80


R. 2 E.
R. 3 E.
440 000 FEET
895 000 FEET
(Joins sheet 50)
(Joins sheet 66)
(Joins sheet 84)
455 000 FEET
885 000 FEET
T. 1 N.
N
Scale 1:20000
1 Mile
5000 Feet
PHOENIX
(county seat)
VAN BUREN STREET
GREENWOOD CEMETERY
ROSEDALE CEMETERY
PORTER CEMETERY
OLD CITY CEMETERY
MARICOPA CO CEMETERY
CITY OF PHOENIX WASTE STABILIZATION POND
ROOSEVELT CANAL
GRAVEL PIT
SOUTHERN PACIFIC
AT & SF
AND SANTA FE
TOPEKA
ATCHISON
CENTRAL AVENUE
SOIL SURVEY LIMIT
OF
Ao
Gt
GgA
Cn
Mr
Es
Le
LcA
Ms
Tt
Ma
Tc
Aa
Gr
Cb
Vg
Vn
TD


N
R. 10 W.
(Joins sheet 51)
80 000 FEET
880 000 FEET
870 000 FEET
60 000 FEET
T. 1 N.
1 Mile
5000 Feet
Scale · 1 : 20000
EAGLETAIL MOUNTAINS
Eagletail Peak
SURVEY
COUNTY SOIL
YUMA
OF
LIMIT
1 6
HLC
CO
GYD
RS
AGB
PT
(Joins sheet 69)
(Joins sheet 85)



(85) | (Joins sheet 86)

N

(Joins sheet 53)

R. 9 W.

125 000 FEET

880 000 FEET

T. 1 N.

(Joins sheet 71)

(Joins sheet 69)

870 000 FEET

105 000 FEET

(Joins sheet 87)

(86)

1 Mile 5000 Feet

Scale 1:20000

0 0 1000 2000 3000 4000 5000

HARQUAHALA PLAINS

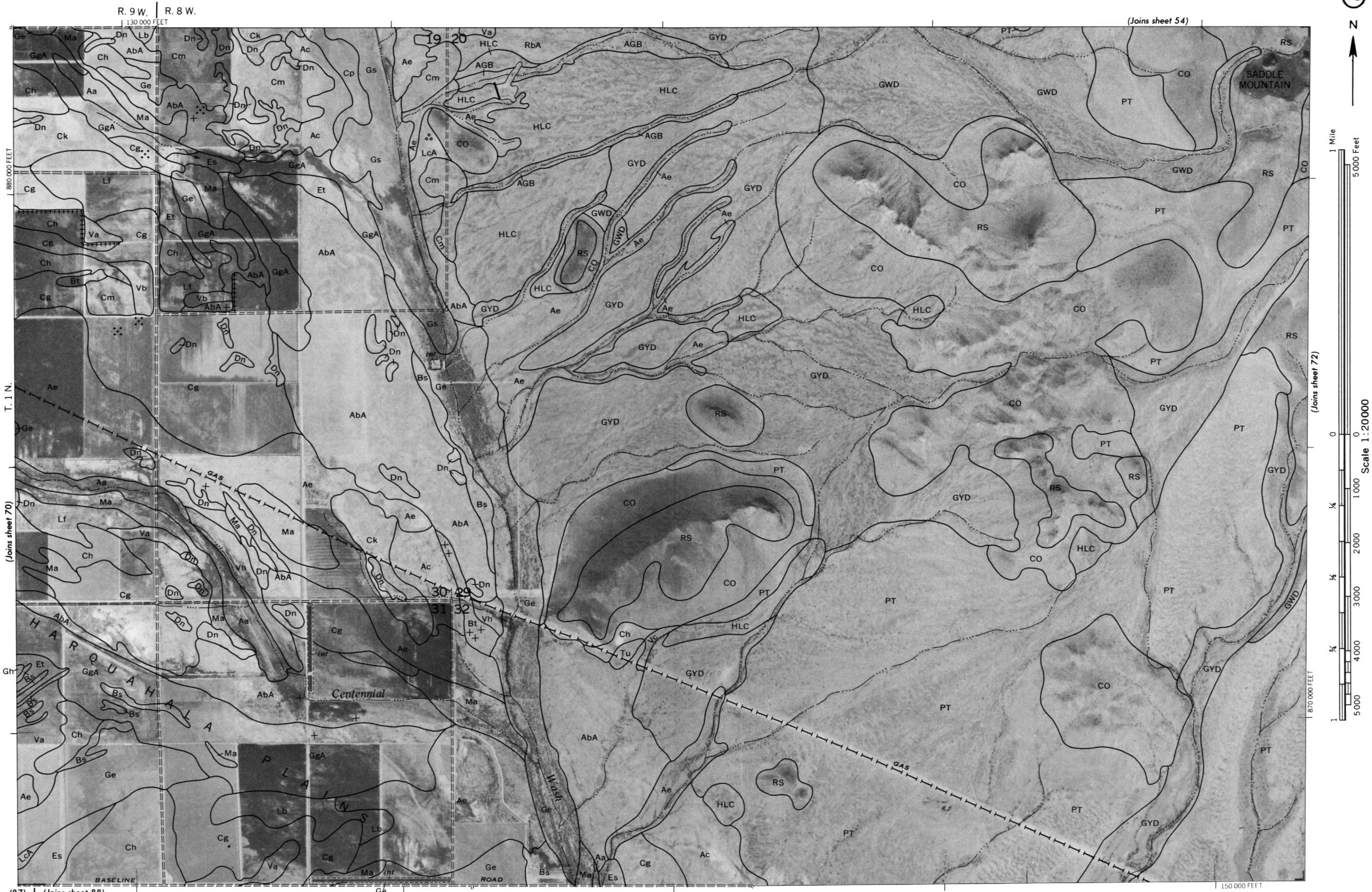
Centennial Wash

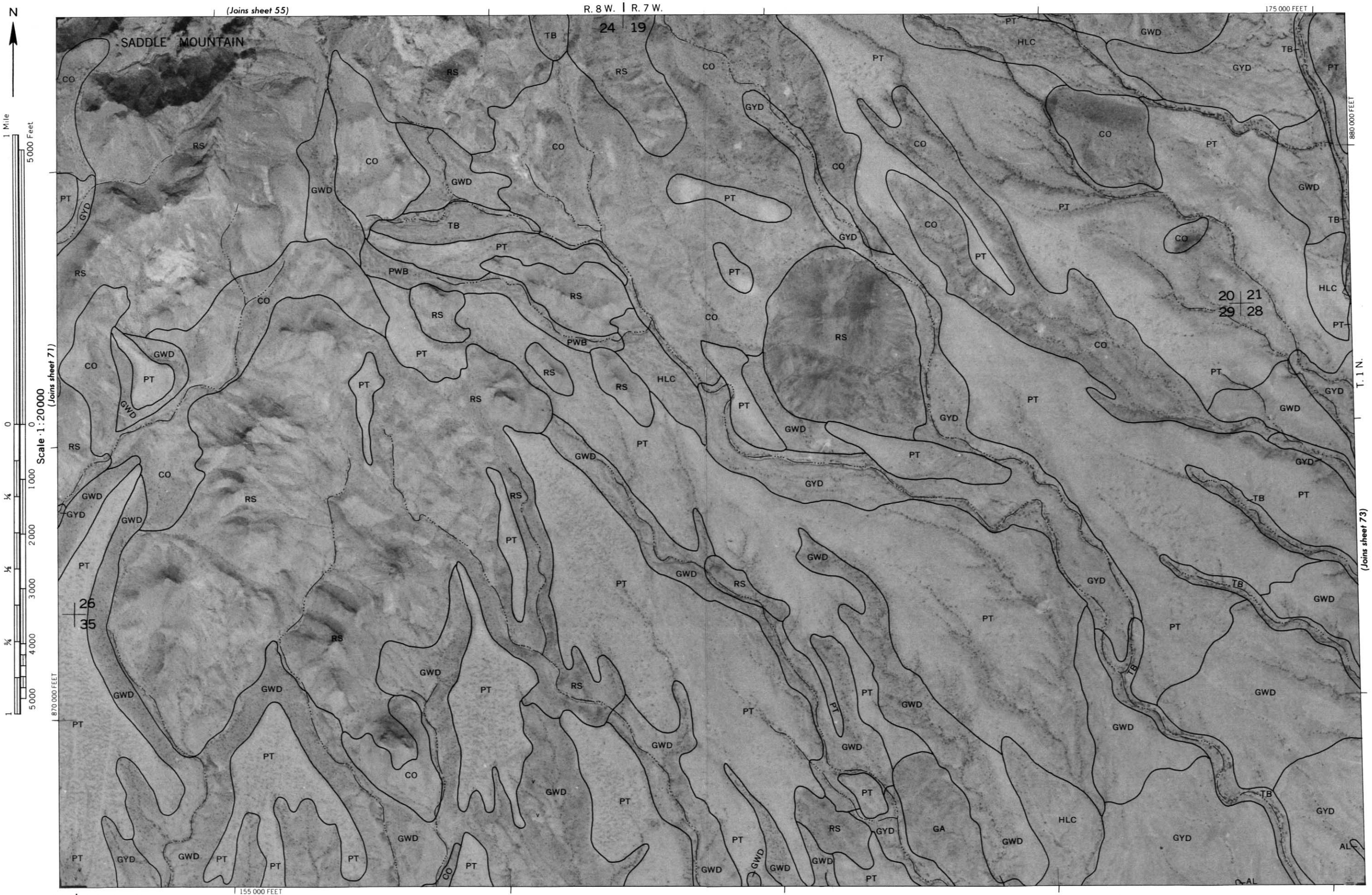
BASELINE ROAD

20 21 22 23 24 25 26 27 28 29 32

int

AbA Ae Aa Ac Bs Bt Ch Cb Cg Cp Dn Ck Et Es Gf Ge GgA Gh Lb Lf LcA Ma Mo Mp PeA Tu Va


71
N
R. 9 W.
R. 8 W.
130 000 FEET
(Joins sheet 54)
SADDLE MOUNTAIN
880 000 FEET
T. 1 N.
(Joins sheet 70)
(Joins sheet 72)
870 000 FEET
HARQUAHALA PLAINS
Centennial
Wash
GAS
BASELINE
ROAD
(87)
(Joins sheet 88)
150 000 FEET
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000


N
Scale 1:20000
1 Mile
5000 Feet
(Joins sheet 55)
(Joins sheet 71)
(Joins sheet 73)
R. 8 W.
R. 7 W.
T. 1 N.
175 000 FEET
880 000 FEET
870 000 FEET
155 000 FEET
SADDLE MOUNTAIN
24 19
20 21
29 28
26
35
CO
RS
GWD
PT
TB
GYD
PWB
HLC
GA
AL

N

180 000 FEET

R. 7 W. | R. 6 W.

(Joins sheet 56)

880 000 FEET

T. 1 N.

(Joins sheet 72)

(Joins sheet 74)

870 000 FEET

195 000 FEET

(Joins sheet 90)

21 | 22

18
19

28 | 27
33 | 34

27 | 26
34 | 35

34 35 36

35

P A L O V E R D E
H I L L S

BASELINE

ROAD

1 Mile

5000 Feet

Scale 1:20000

1 0 0 1000 2000 3000 4000 5000

¼ ½ ¾


N
Scale · 1:20000
1 Mile
5000 Feet
0
(Joins sheet 57)
(Joins sheet 73)
(Joins sheet 91)
(Joins sheet 75)
R. 6 W.
T. 1 N.
220 000 FEET
880 000 FEET
870 000 FEET
200 000 FEET
SALOME ROAD
BASELINE ROAD
Wash
Winters
Fourmile
20
23 24
21 22
28 27
29 28
32 33
26 25
35 36
33 34


R. 6 W.
R. 5 W.
225 000 FEET
880 000 FEET
870 000 FEET
245 000 FEET
(Joins sheet 58)
(Joins sheet 76)
(Joins sheet 92)
(Joins sheet 74)
T. 1 N.
N
Phillips Wash
Dickey Wash
Luke Wash
HASSAYAMPA RIVER
SALOME ROAD
BASELINE ROAD
19 20
30 39
21 22
28 27
33 34
31 32
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
¼
½
¾
1


(Joins sheet 59)
R. 5 W.
R. 4 W.
270 000 FEET
880 000 FEET
T. 1 N.
(Joins sheet 75)
(Joins sheet 77)
(Joins sheet 93)
250 000 FEET
870 000 FEET
N
1 Mile
5 000 Feet
Scale · 1 : 20000
LUKE AUXILIARY FIELD NO 5
ROOSEVELT CANAL
HASSAYAMPA RIVER
BASELINE
ROAD
BUCKEYE VALLEY
23 24 26 25
26 25 35 36
30 29 31 32
GYD
PRB
AbA
RaA
Cp
Lb
Pa
PeA
PeB
Ma
Ae
Aa
Bs
Va
CF
TD
Vg
AdA
GgA
Ge
Cb
CV
CrB
LcA

77

N

275 000 FEET

880 000 FEET

R. 4 W. | R. 3 W.

(Joins sheet 60)

T. 1 N.

(Joins sheet 76)

(Joins sheet 78)

(Joins sheet 94)

ROOSEVELT CANAL

BASEBUCKEYE VALLEY

BASELINE ROAD

SP

870 000 FEET

290 000 FEET

1 Mile

5000 Feet

Scale 1:20000

1 0 1 2 3 4 5000 4000 3000 2000 1000 0

N

1 Mile 5000 Feet

0 0

Scale 1:20000

1000 2000 3000 4000 5000

(Joins sheet 61)

R. 3 W.

315 000 FEET

880 000 FEET

T. 1 N.

(Joins sheet 77)

(Joins sheet 79)

870 000 FEET

295 000 FEET

(Joins sheet 95)

ROOSEVELT CANAL

LOUIS B HAZELTON CEMETERY

SOUTHERN PACIFIC BUCKEYE CANAL

BASELINE ROAD

Valencia

BUCKEYE VALLEY

21 22 23 24 25 26 27 28 29 32 33 34 35 36

79

R. 3 W. | R. 2 W.

320 000 FEET

880 000 FEET

T. 1 N.

(Joins sheet 62)

(Joins sheet 78)

(Joins sheet 80)

(Joins sheet 96)

340 000 FEET

870 000 FEET

N

1 Mile

5000 Feet

Scale 1:20000

0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000

19 20 21 22 28 27 30 29 31 32

B U C K E Y E V A L L E Y

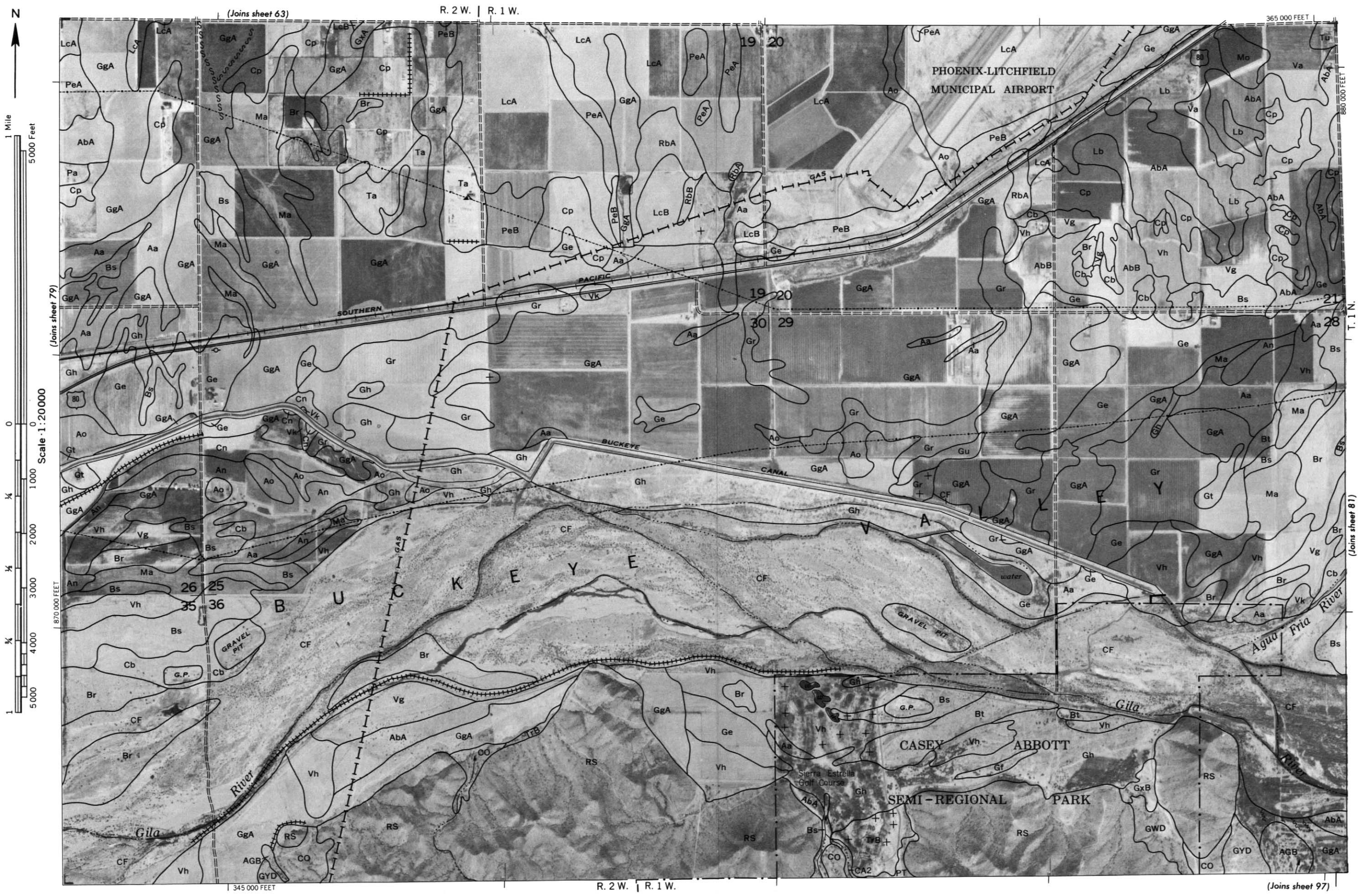
Liberty

PACIFIC SOUTHERN BUCKEYE CANAL EXTENSION CANAL SOUTH BUCKEYE CANAL

Gila River

80

AbA Aa Ao Bs CF Cn Cp Ge GgA Gh Gt LcA Lb Ma PeA PeB Pa PsA


N
Scale · 1:20000
1 Mile
5000 Feet
0
¼
½
¾
1
1000
2000
3000
4000
5000
(Joins sheet 63)
(Joins sheet 79)
(Joins sheet 81)
(Joins sheet 97)
R. 2 W.
R. 1 W.
T. 1 N.
365 000 FEET
880 000 FEET
870 000 FEET
345 000 FEET
PHOENIX-LITCHFIELD
MUNICIPAL AIRPORT
BUCKEYE
VALLEY
CASEY ABBOTT
SEMI-REGIONAL PARK
Sierra Estrella Golf Course
GRAVEL PIT
GRAVEL PIT
G.P.
G.P.
SOUTHERN PACIFIC
BUCKEYE CANAL
GAS
GAS
Gila River
Gila River
Agua Fria River
water
19
20
30
29
21
28
25
26
35
36

(Joins sheet 64)

370 000 FEET

R. 1 W. | R. 1 E.

880 000 FEET

T. 1 N.

(Joins sheet 80)

(Joins sheet 82)

(Joins sheet 98)

385 000 FEET

865 000 FEET

N

1 Mile

5000 Feet

Scale 1:20000

Gila River

Salt River

Agua Fria

Monument Hill

GILA RIVER INDIAN RESERVATION SURVEY BOUNDARY

RS LIMIT

PT


82
N
1 Mile
5 000 Feet
0
1000
2000
3000
4000
5000
Scale 1:20000
R. 1 E.
T. 1 N.
(Joins sheet 65)
(Joins sheet 81)
(Joins sheet 83)
(Joins inset, sheet 115)
410 000 FEET
880 000 FEET
865 000 FEET
390 000 FEET
Santa Maria
83RD AVENUE
Salt River
GILA RIVER INDIAN RESERVATION
LIMIT OF SOIL SURVEY BOUNDARY
BASELINE ROAD
21
22
28
27
23
24

MARICOPA COUNTY, ARIZONA, CENTRAL PART — SHEET NUMBER 83

83

415 000 FEET

R. 2 E.

(Joins sheet 66)

880 000 FEET

T. 1 N.

(Joins sheet 82)

(Joins sheet 84)

870 000 FEET

435 000 FEET

(Joins sheet 99)

CITY OF PHOENIX WASTE STABILIZATION POND

GRAVEL PIT

Salt River

BASELINE ROAD

59TH AVENUE

21 22
28 27

N

1 Mile 5000 Feet

Scale 1:20000

N

R. 2 E. | R. 3 E.

455 000 FEET

880 000 FEET

870 000 FEET

440 000 FEET

T. 1 N.

1 Mile 5000 Feet

Scale 1:20000

0 1000 2000 3000 4000 5000

¼ ¼ ¾ 1

(Joins sheet 67)

(Joins sheet 83)

(Joins sheet 100)

SOUTH PHOENIX

CITY OF PHOENIX WASTE STABILIZATION POND

CITY OF PHOENIX WASTE STABILIZATION POND

GRAVEL PIT

Salt River

SOUTH SAN FRANCISCO CANAL

WESTERN CANAL

BRANCH

BASELINE ROAD

SURVEY LIMIT

MARICOPA COUNTY, ARIZONA, CENTRAL PART — SHEET NUMBER 85

(Joins sheet 68) | (69)

60 000 FEET

R. 10 W.

865 000 FEET

T. 1 S.

SOIL SURVEY

YUMA COUNTY LIMIT OF

EAGLETAIL MOUNTAINS

HLC CO GYD RS AGB PT PRB GWD

5 4 8 9 7 8 18 17 13 18 17 16

(Joins sheet 86)

855 000 FEET

(Joins sheet 101)

80 000 FEET

N

1 Mile 5000 Feet

Scale 1:20000

0 1000 2000 3000 4000 5000

(Joins sheet 69) | (70)

105 000 FEET

R. 10 W. | R. 9 W.

N

1 Mile

5000 Feet

0

Scale 1:20000

(Joins sheet 85)

3 2

9 10

16 15

6

7

T. 1 S.

865 000 FEET

855 000 FEET

85 000 FEET

EAGLETAIL MOUNTAINS

BASELINE ROAD

RS GYD EPD HLC AGB Bs Ma LcA TrA GgA Ge Cp Lb AbA Es Va Aa Ac Bt RaA Cb AHC CO PYD PT GWD CV PRIB Pa Br

(Joins sheet 87)

(Joins sheet 102)

MARICOPA COUNTY, ARIZONA, CENTRAL PART — SHEET NUMBER 87

87

N

R. 9 W.

BASELINE

ROAD

110 000 FEET

125 000 FEET

865 000 FEET

855 000 FEET

T. 1 S.

(Joins sheet 70) (71)

(Joins sheet 88)

(Joins sheet 86)

(Joins sheet 103)

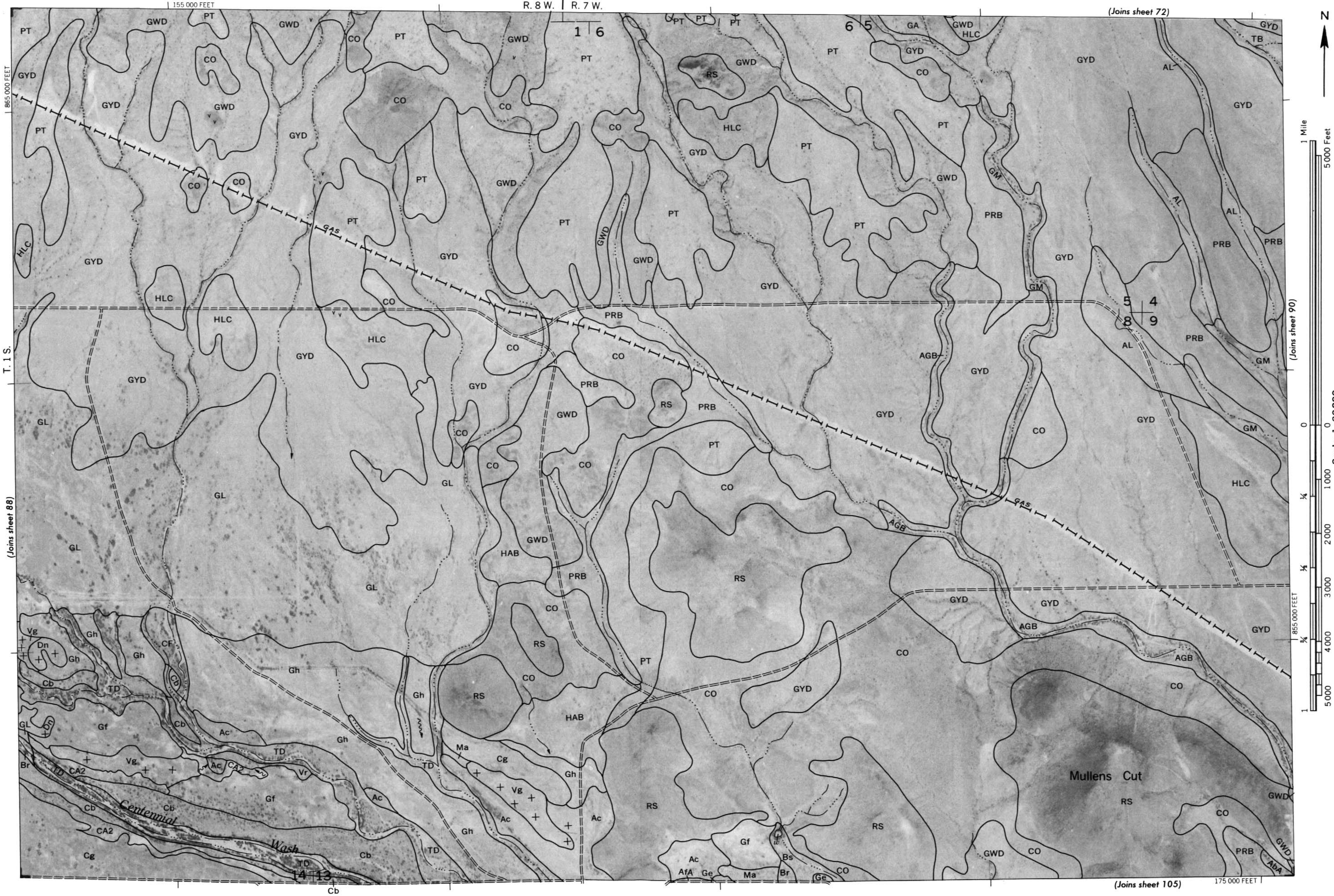
1 Mile

5 000 Feet

Scale 1:20000

1 0 0 1000 2000 3000 4000 5000


N
R. 9 W.
R. 8 W.
(Joins sheet 71)
150 000 FEET
865 000 FEET
BASELINE ROAD
GAS
H A R Q U A H A L A
P L A I N S
Centennial Wash
T. 1 S.
(Joins sheet 87)
(Joins sheet 89)
Scale 1:20000
1 Mile
5000 Feet
855 000 FEET
130 000 FEET
(Joins sheet 104)


89
N
R. 8 W.
R. 7 W.
155 000 FEET
865 000 FEET
(Joins sheet 72)
(Joins sheet 88)
(Joins sheet 90)
(Joins sheet 105)
T. 1 S.
855 000 FEET
175 000 FEET
GAS
Centennial
Wash
Mullens Cut
1 Mile
5000 Feet
Scale 1:20000
PT
GWD
GYD
CO
HLC
RS
PRB
GL
AL
GM
AGB
HAB
Gh
Gf
Cb
Cg
TD
Ac
Vg
Vr
CA2
Dn
CF
Ma
Br
Bs
Ge
AfA
GA
TB
AdA

N

1 Mile 5000 Feet

0 0

Scale 1:20000

1 1000 2000 3000 4000 5000

(Joins sheet 73)

BASELINE

ROAD

R. 7 W. | R. 6 W.

195 000 FEET

865 000 FEET

855 000 FEET

180 000 FEET

(Joins sheet 89)

(Joins sheet 91)

(Joins sheet 106)

T. 1 S.

21 | 6 | 7 | 18

4 | 3 | 9 | 10

11 | 12 | 14 | 13

GAS

GYD TB AL PRB GM GN HLC GxA GxB GgA PeA LcA Pb Ld Ae Cb RbA Aa Ma Ge RS RhB Es Vb Tu HAB Cm Te Ch GWD AGB

200 000 FEET

865 000 FEET

R. 6 W.

(Joins sheet 74)

T. 1 S.

(Joins sheet 90)

(Joins sheet 92)

855 000 FEET

(Joins sheet 107)

220 000 FEET

N

1 Mile

5000 Feet

Scale 1:20000

Winters Wash


N
R. 6 W.
R. 5 W.
(Joins sheet 75)
(Joins sheet 91)
(Joins sheet 93)
(Joins sheet 108)
245 000 FEET
865 000 FEET
855 000 FEET
225 000 FEET
T. 1 S.
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
¼
½
¾
1
BASELINE
ROAD
SALOME
ROAD
Dixie
SOUTHERN
PACIFIC
Luke
Arlington Mesa
HAC
Vb
RaA
Cg
HAC
GYD
Ck
Gh
HLC
AGB
Ac
PRB
AM
GgA
LcA
PeA
Cm
CV
PT
CO
CA2
GWD
RS
AbA
HAB
GxA
Ld
Ch
Cp
Lb
Es
GM
Dn
1 6
6 5
5 4
4 3
5 4 / 8 9
4 3 / 9 10
3 / 10
12 7 / 13 18
7 8 / 18 17
9 10 / 16 15

MARICOPA COUNTY, ARIZONA, CENTRAL PART — SHEET NUMBER 93

93

N

250 000 FEET

R. 5 W. | R. 4 W.

(Joins sheet 76)

865 000 FEET

T. 1 S.

BASELINE ROAD

PACIFIC SOUTHERN

HASSAYAMPA RIVER

BUCKEYE CANAL

BUCKEYE

VALLEY

Hassayampa

Palo Verde

(Joins sheet 92)

(Joins sheet 94)

(Joins sheet 109)

850 000 FEET

270 000 FEET

1 Mile 5 000 Feet

Scale 1:20000

N

Scale · 1:20000

1 Mile 5000 Feet

0 0

1 000 2000 3000 4000 5000

¼ ½ ¾

(Joins sheet 77)

(Joins sheet 93)

R. 4 W. | R. 3 W.

290 000 FEET

865 000 FEET

850 000 FEET

275 000 FEET

(Joins sheet 95)

Ap (Joins sheet 110)

BASELINE ROAD

PACIFIC SOUTHERN

BUCKEYE CANAL

ARLINGTON CANAL

DISPOSAL PIT

Gila River

Conger

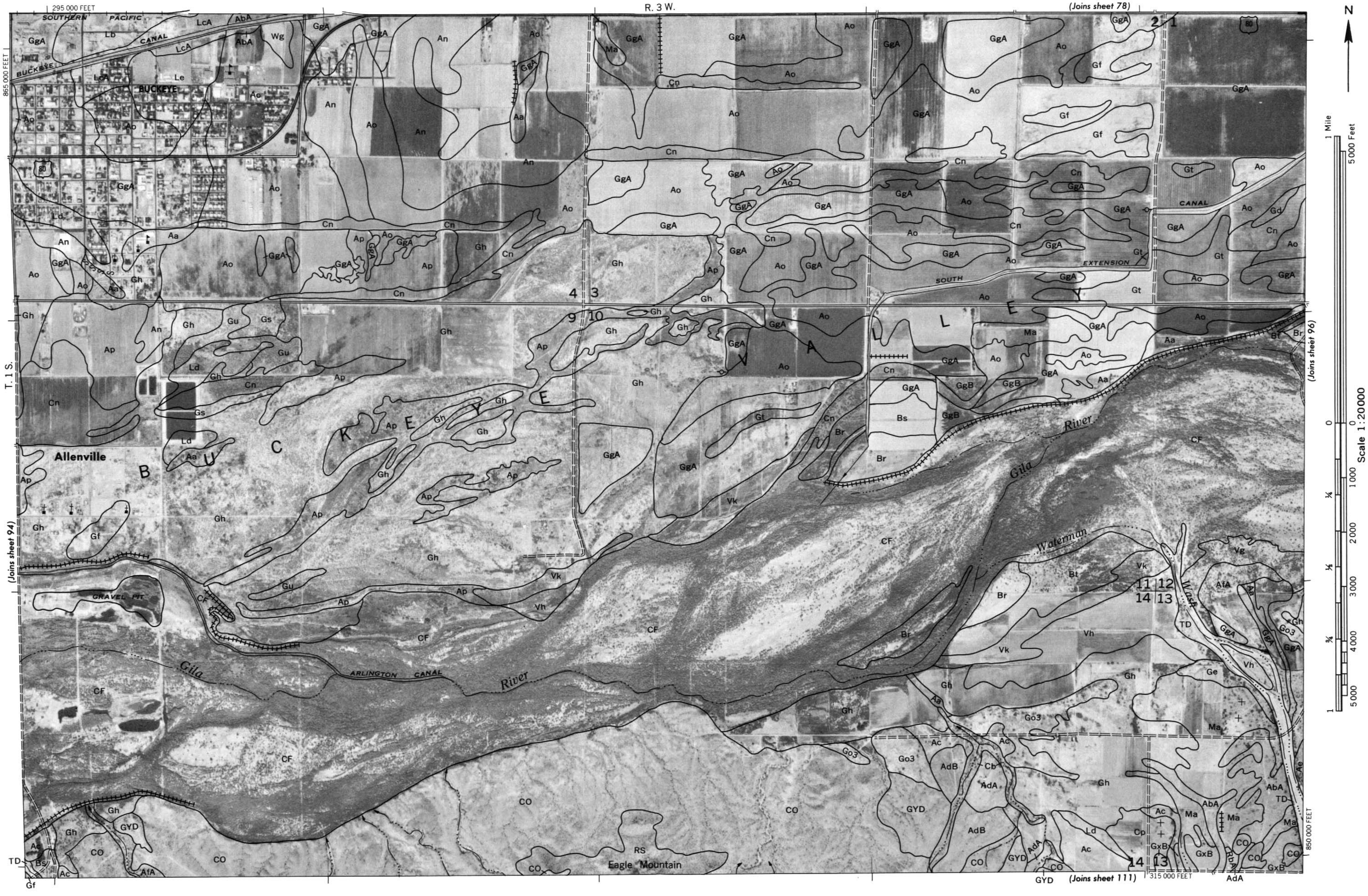
BUCKEYE

VALLEY

CF

TD

4 3 2 1 6 7 9 10 11 12 14 13


295 000 FEET
R. 3 W.
(Joins sheet 78)
865 000 FEET
SOUTHERN PACIFIC
CANAL
BUCKEYE
T. 1 S.
Allenville
B U C K E Y E V A L L E Y
SOUTH EXTENSION
CANAL
(Joins sheet 96)
(Joins sheet 94)
GRAVEL PIT
Gila River
ARLINGTON CANAL
Waterman Wash
Eagle Mountain
(Joins sheet 111)
315 000 FEET
850 000 FEET
N
1 Mile
5000 Feet
Scale 1:20000

N

R. 3 W. | R. 2 W. (Joins sheet 79)

340 000 FEET

865 000 FEET

T. 1 S.

(Joins sheet 95)

(Joins sheet 97)

1 Mile 5000 Feet 0 0 Scale · 1:20000 1000 ¼ 2000 ½ 3000 ¾ 4000 1 5000

BUCKEYE VALLEY

LIBERTY CEMETERY

SOUTH EXTENSION CANAL

Gila River

Corgett Wash

Lum Wash

GRAVEL PIT

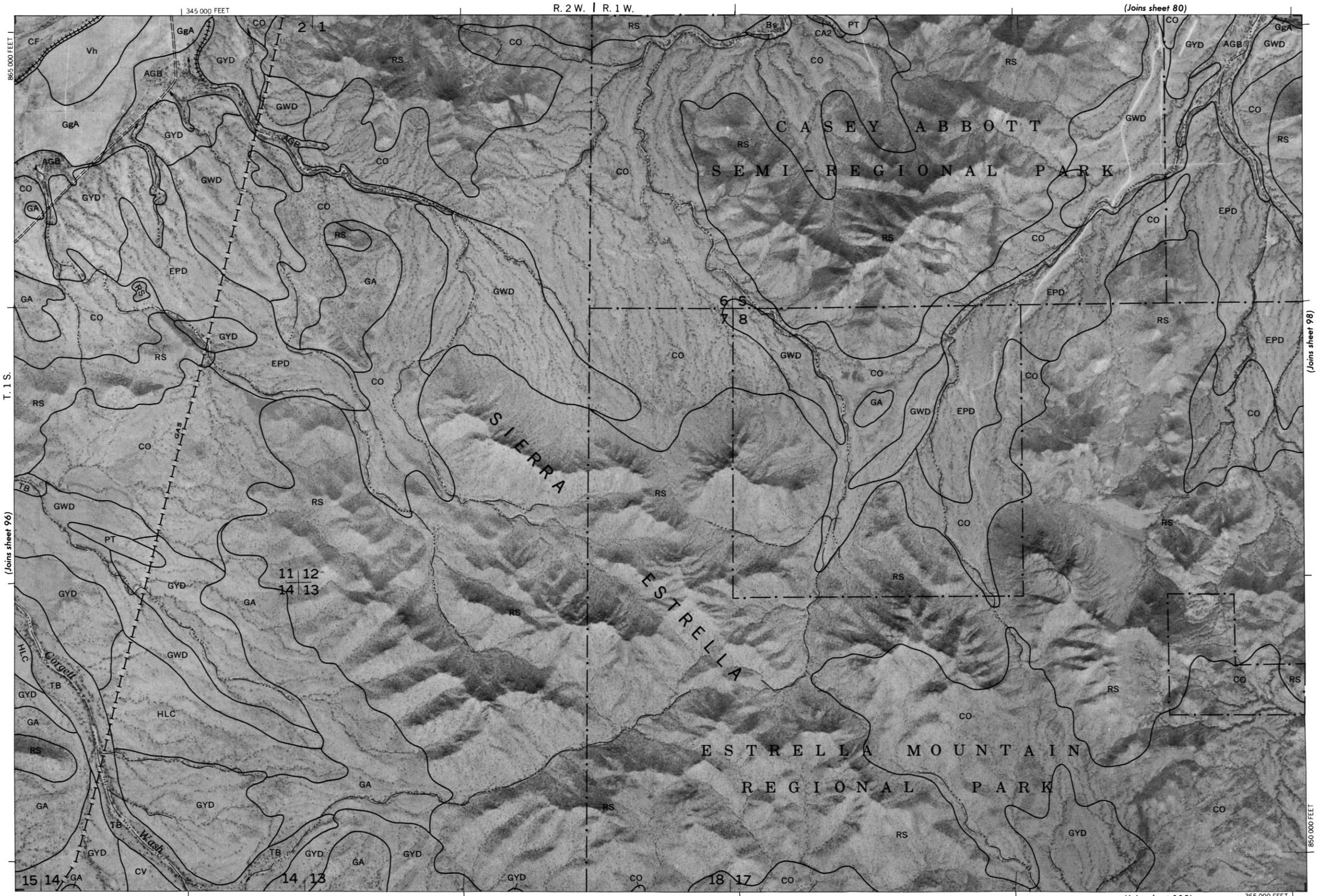
G.P

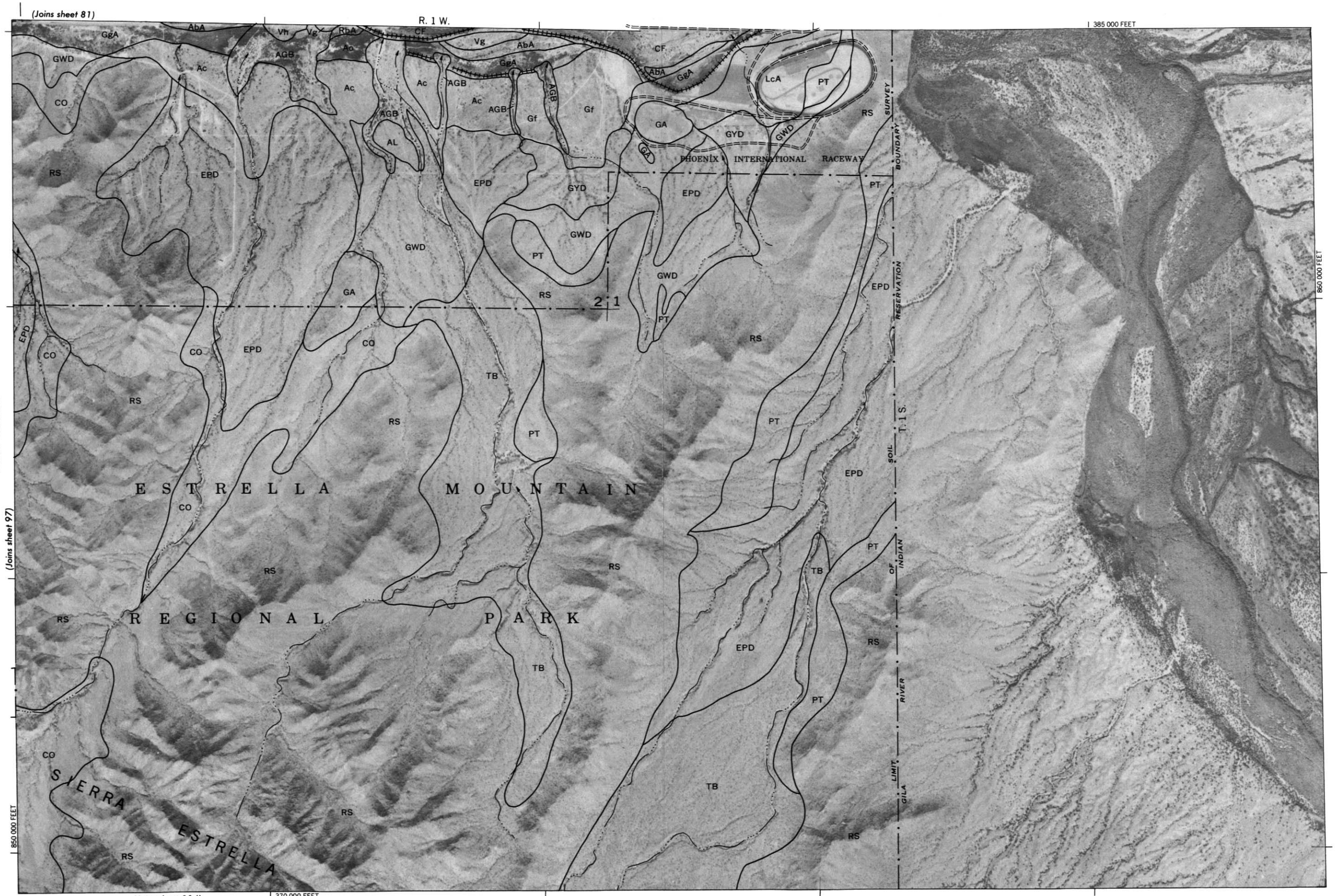
8 9 17 16

17 16

850 000 FEET

320 000 FEET (Joins sheet 112)


345 000 FEET
R. 2 W.
R. 1 W.
(Joins sheet 80)
865 000 FEET
T. 1 S.
(Joins sheet 96)
(Joins sheet 98)
850 000 FEET
365 000 FEET
(Joins sheet 113)
N
1 Mile
5000 Feet
Scale 1:20000
CASEY ABBOTT
SEMI-REGIONAL PARK
SIERRA
ESTRELLA
ESTRELLA MOUNTAIN
REGIONAL PARK
Gas
Corgett
Wash
CF
Vh
GgA
AGB
GYD
GWD
EPD
GA
CO
RS
Bs
CA2
PT
TB
HLC
CV


(Joins sheet 81)
R. 1 W.
385 000 FEET
N
1 Mile
5000 Feet
0
Scale 1:20000
1000
2000
3000
4000
5000
(Joins sheet 97)
850 000 FEET
860 000 FEET
(Joins sheet 114)
370 000 FEET
E S T R E L L A M O U N T A I N
R E G I O N A L P A R K
S I E R R A E S T R E L L A
PHOENIX INTERNATIONAL RACEWAY
SURVEY BOUNDARY
RESERVATION
SOIL
T. 1 S.
OF INDIAN
RIVER
LIMIT
GILA
2 1
AbA
Ac
AGB
AL
CF
CO
EPD
GA
GgA
GWD
GYD
Gf
LcA
PT
RbA
RS
TB
Vg
Vh

(Joins sheet 83)

415 000 FEET

R. 2 E.

BASELINE

ROAD

6 5 4 3

59TH AVENUE

Laveen

T. 1 S.

860 000 FEET

(Joins inset, sheet 115)

LIMIT OF GILA RIVER INDIAN RESERVATION SOIL SURVEY BOUNDARY

WESTERN CANAL

PHOENIX SOUTH MOUNTAIN PARK

PARK BDY

850 000 FEET

435 000 FEET

(Joins sheet 100)

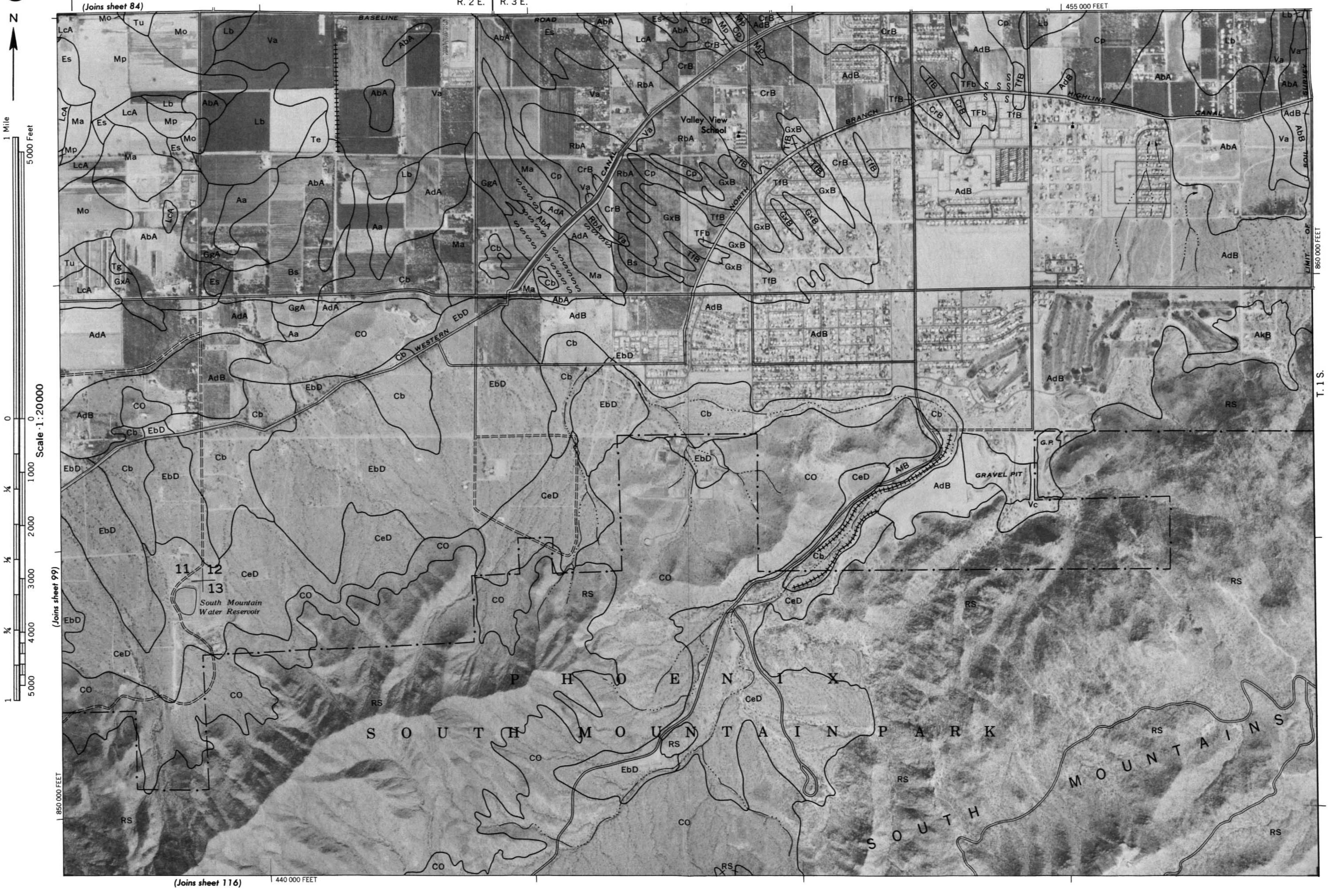
(Joins sheet 115)

N

Scale 1:20000

1 Mile

5000 Feet


(Joins sheet 84)
R. 2 E.
R. 3 E.
455 000 FEET
N
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
(Joins sheet 99)
(Joins sheet 116)
440 000 FEET
850 000 FEET
860 000 FEET
T. 1 S.
BASELINE ROAD
HIGHLINE CANAL
NORTH BRANCH
WESTERN CANAL
LIMIT OF SOIL
Valley View School
GRAVEL PIT
G.P.
South Mountain Water Reservoir
11
12
13
PHOENIX
SOUTH MOUNTAIN PARK
SOUTH MOUNTAINS

MARICOPA COUNTY, ARIZONA, CENTRAL PART — SHEET NUMBER 101

101

N

60 000 FEET

850 000 FEET

R. 10 W.

(Joins sheet 85)

24 | 19 | 20 | 21

20 | 21
29 | 28

29 | 28
32 | 33

AL 32 | 33

T. 1 S.

SOIL SURVEY

COUNTY OF YUMA LIMIT

CEMETERY RIDGE

GWD AGB GYD GN HLC CO RS PRB RbA AL

(Joins sheet 102)

840 000 FEET

80 000 FEET

1 Mile 5 000 Feet

Scale 1:20000

N

Scale 1:20000

1 Mile 5000 Feet

0 0

1/4 1/2 3/4 1 1000 2000 3000 4000 5000

(Joins sheet 86)

(Joins sheet 101)

(Joins sheet 103)

R. 10 W. | R. 9 W.

100 000 FEET

850 000 FEET

840 000 FEET

T. 1 S.

85 000 FEET

EAGLETAIL MOUNTAINS

24 | 19
Cp Ma Pa

23 | 24
26 | 25

24 | 19
25 | 30

27 | 26
34 | 35

26 | 25
35 | 36

25 | 30
36 | 31

CO GYD PRB PT GWD RS HLC AGB AL CV

N

105 000 FEET

850 000 FEET

R. 9 W.

T. 1 S.

(Joins sheet 87)

(Joins sheet 104)

(Joins sheet 102)

840 000 FEET

125 000 FEET

23 | 24
26 | 25

28 | 27
33 | 34

26 | 25
35 | 36

Fourth of July Wash

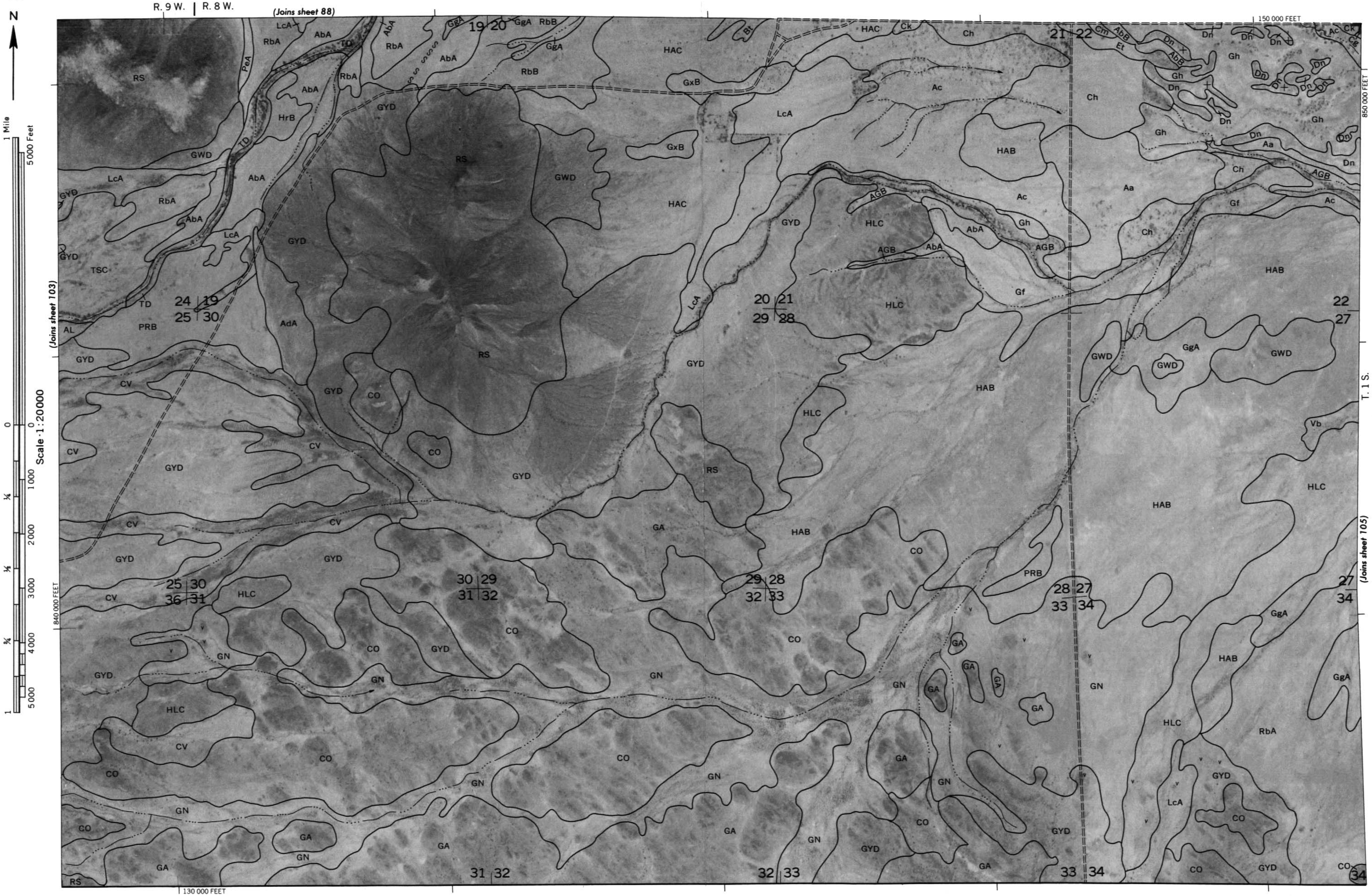
1 Mile

5000 Feet

Scale 1:20000

0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000


N
R. 9 W.
R. 8 W.
(Joins sheet 88)
150 000 FEET
850 000 FEET
T. 1 S.
(Joins sheet 105)
(Joins sheet 103)
840 000 FEET
130 000 FEET
1 Mile
5000 Feet
Scale 1:20000

MARICOPA COUNTY, ARIZONA, CENTRAL PART — SHEET NUMBER 105

105

N

155 000 FEET

(Joins sheet 89)

R. 8 W.

R. 7 W.

850 000 FEET

T. 1 S.

Mullens Cut

Centennial Wash

(Joins sheet 104)

(Joins sheet 106)

835 000 FEET

175 000 FEET

1 Mile

5000 Feet

Scale 1:20000

N

Scale 1:20000

1 Mile 5000 Feet

0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000

(Joins sheet 90)

(Joins sheet 105)

(Joins sheet 107)

R. 7 W. | R. 6 W.

T. 1 S.

195 000 FEET

850 000 FEET

835 000 FEET

180 000 FEET

Centennial Wash

PACIFIC SOUTHERN

21 22 23 24
28 27 26 25
30
31
35 36

AbA GWD AGB GYD GN AL GgA RhB LcA PRB GxA PeA HLC HAB Te Airstrip Th Ch Tu Es Ch Aa Ma Ge GM RS CO

MARICOPA COUNTY, ARIZONA, CENTRAL PART — SHEET NUMBER 107

107

200 000 FEET

R. 6 W.

(Joins sheet 91)

850 000 FEET

T. 1 S.

(Joins sheet 106)

(Joins sheet 108)

835 000 FEET

220 000 FEET

N

1 Mile

5000 Feet

Scale 1:20000

Winters Wash

Centennial Wash

Crag

PACIFIC SOUTHERN GAS

N

R. 6 W. | R. 5 W.

(Joins sheet 92)

245 000 FEET

850 000 FEET

T. 1 S.

(Joins sheet 107)

(Joins sheet 109)

(Joins sheet 117)

225 000 FEET

835 000 FEET

1 Mile

5000 Feet

Scale 1:20000

Arlington Station

Arlington

Arlington School

Airstrip

Luke Wash

ARLINGTON CANAL

VALLEY

Gila River

ARLINGTON

CANAL

19 20 30 29

21 22 28 27

36 31

Br 34

250 000 FEET

850 000 FEET

R. 5 W. | R. 4 W.

(Joins sheet 93)

N

T. 1 S.

(Joins sheet 108)

(Joins sheet 110)

1 Mile

5000 Feet

Scale 1:20000

835 000 FEET

270 000 FEET

CANAL

ARLINGTON

RIVER

HASSAYAMPA

River

Gila

Robins Butte

Powers Butte

B U C K E Y E H I L L S


110
N
1 Mile
5000 Feet
Scale 1:20000
(Joins sheet 94)
(Joins sheet 109)
(Joins sheet 111)
R. 4 W. | R. 3 W.
290 000 FEET
845 000 FEET
835 000 FEET
275 000 FEET
T. 1 S.
ARLINGTON
CANAL
Gila River
BUCKEYE HILLS
80

R. 3 W.

(Joins sheet 95)

295 000 FEET

845 000 FEET

T. 1 S.

(Joins sheet 110)

(Joins sheet 112)

835 000 FEET

315 000 FEET

Eagle Mountain

BUCKEYE HILLS

16 15
21 22

23 24
26 25

28 27
33 34

27 26
34 35

26 25
35 36

HLC

N

1 Mile

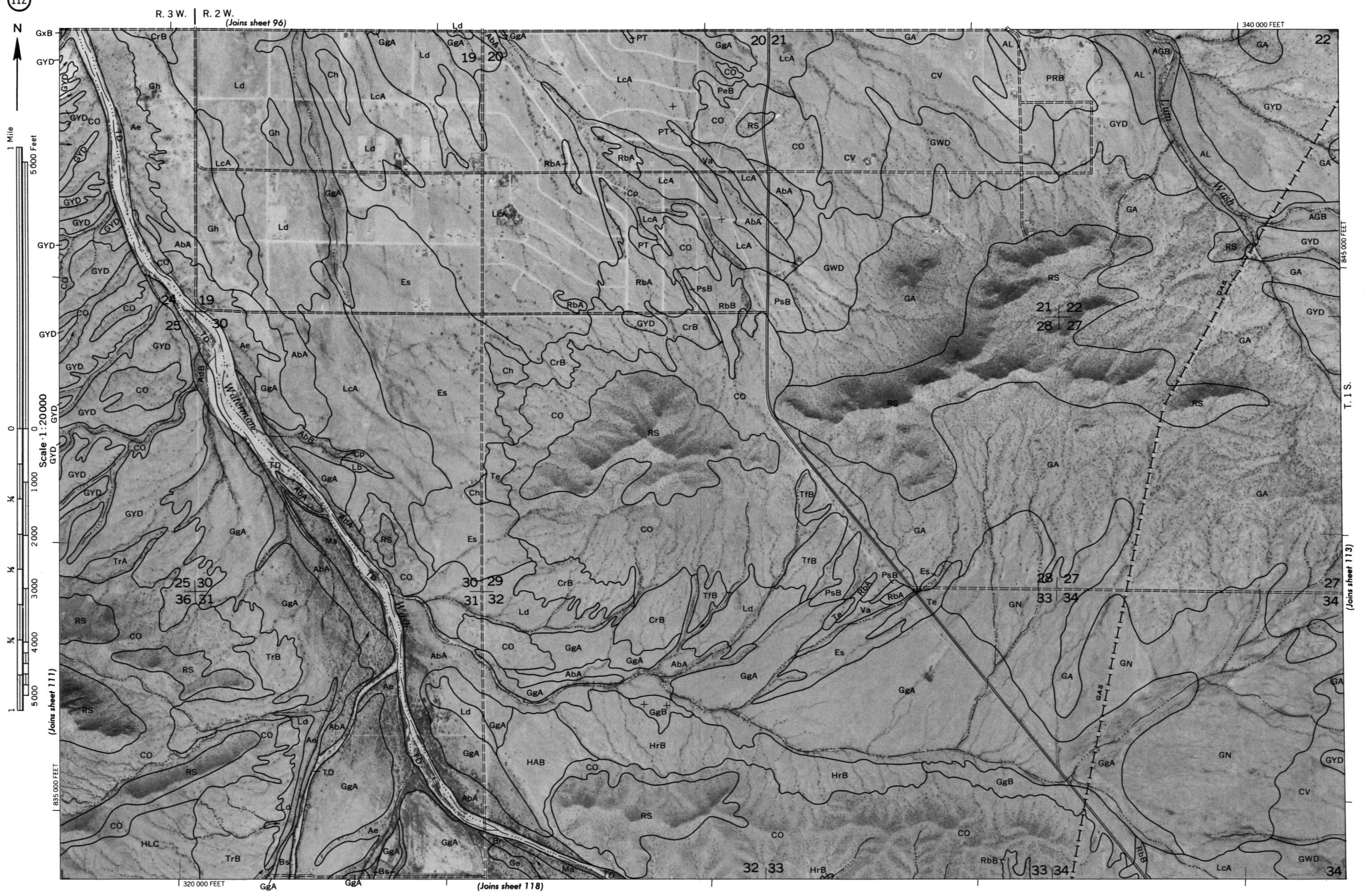
5000 Feet

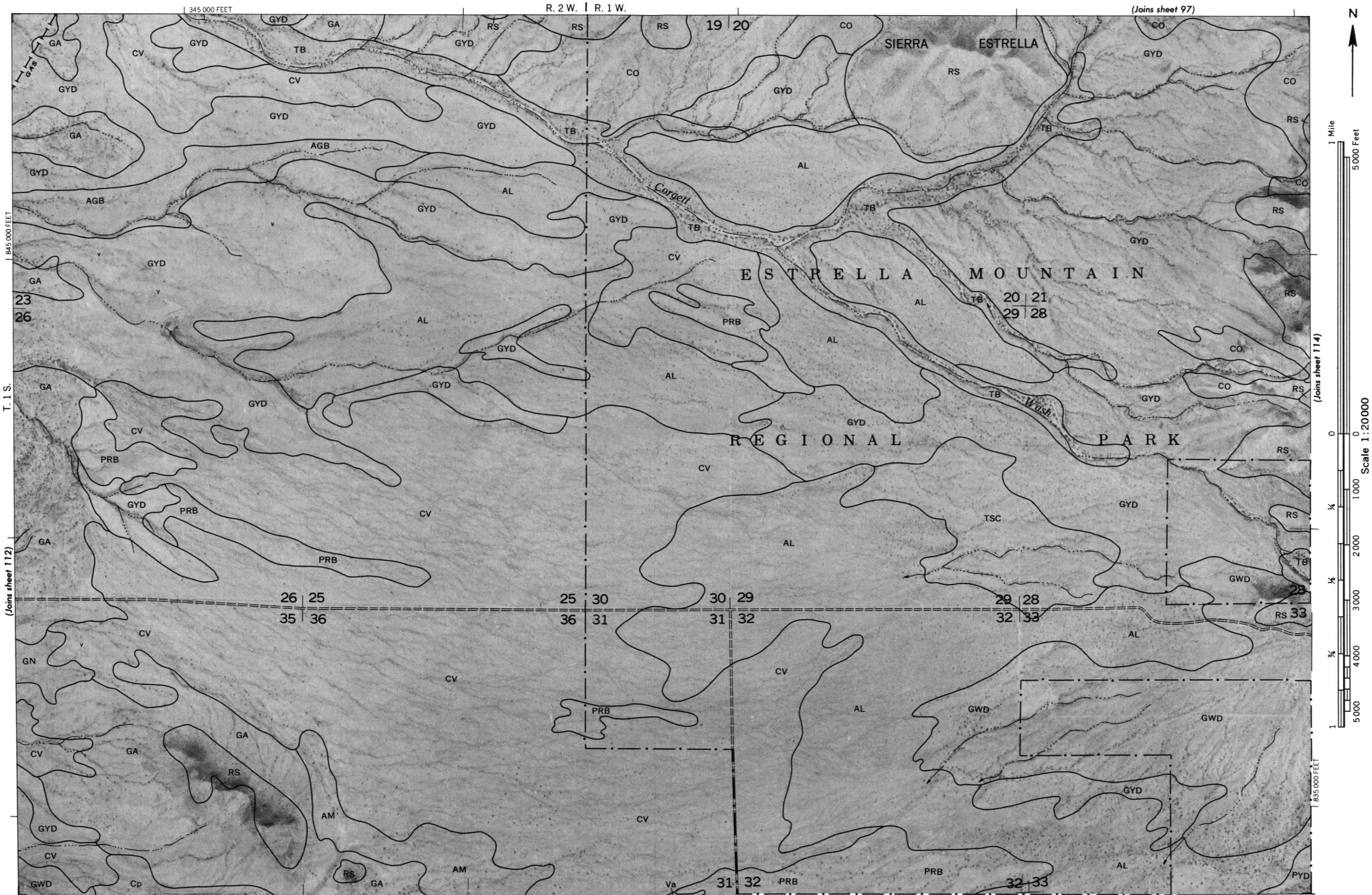
Scale 1:20000

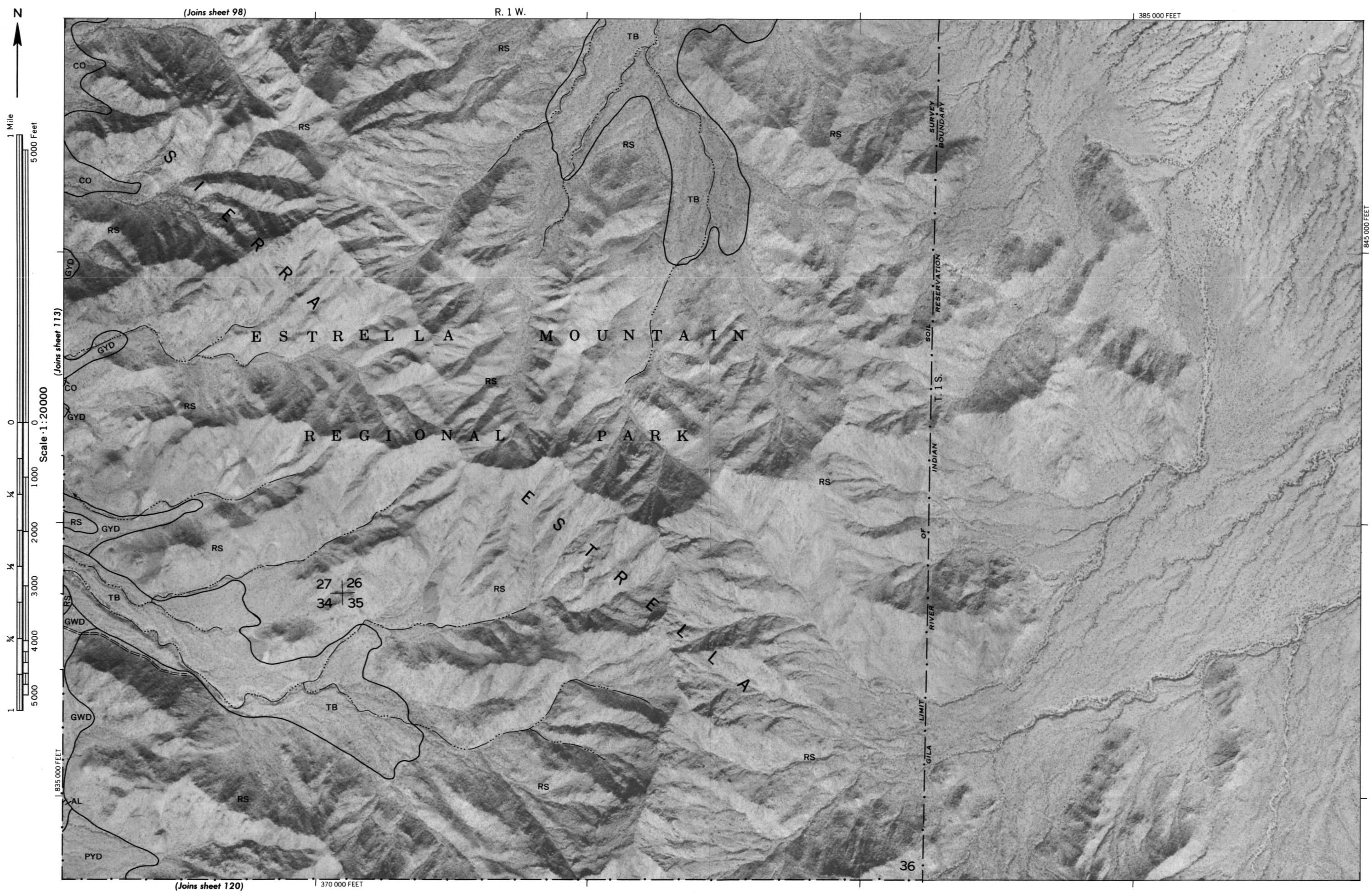
0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000

Bs Ac TD Gf AfA CO RS GYD AdB AdA Ac Cp Pc Ma AbA RbA GxB Ae Te AbA AGB


N
R. 3 W.
R. 2 W.
(Joins sheet 96)
(Joins sheet 111)
(Joins sheet 113)
(Joins sheet 118)
T. 1 S.
340 000 FEET
845 000 FEET
835 000 FEET
320 000 FEET
1 Mile
5 000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
¼
½
¾
1
Waterman Wash
Lum Wash
GAS
RS
CO
GA
GYD
GWD
CV
AL
AGB
PRB
LcA
Ld
Es
GgA
AbA
TD
Ae
CrB
HrB
HAB
HLC
TrB
TrA
GN
GgB
TfB
PsB
RbA
RbB
Va
Te
Ch
Gh
Ma
Bs
Br
Ge
Lb
Cp
PT
PeB
AdB
AbB
GxB
20 21
19 20
24 19
25 30
21 22
28 27
30 29
31 32
25 30
36 31
28 27
33 34
27
34
22
32 33
33 34
34


113
N
345 000 FEET
R. 2 W. | R. 1 W.
(Joins sheet 97)
SIERRA ESTRELLA
ESTRELLA MOUNTAIN
REGIONAL PARK
Corgett Wash
GAS
845 000 FEET
T. 1 S.
(Joins sheet 112)
(Joins sheet 114)
(Joins sheet 119)
835 000 FEET
365 000 FEET
R. 2 W. | R. 1 W.
19 20
23 26
20 21 29 28
26 25 35 36
25 30 36 31
30 29 31 32
29 28 32 33
31 32
32 33
GYD
GA
CV
TB
RS
CO
AGB
AL
PRB
TSC
GWD
GN
AM
Cp
Va
PYD
Scale 1:20000
1 Mile
5000 Feet
0
1000
2000
3000
4000
5000


N
1 Mile
5000 Feet
0
0
1000
2000
3000
4000
5000
Scale 1:20000
(Joins sheet 98)
R. 1 W.
385 000 FEET
845 000 FEET
835 000 FEET
370 000 FEET
(Joins sheet 113)
(Joins sheet 120)
SIERRA ESTRELLA
ESTRELLA MOUNTAIN REGIONAL PARK
GILA RIVER INDIAN RESERVATION SOIL SURVEY BOUNDARY
LIMIT OF
T. 1 S.
CO
RS
TB
GYD
GWD
AL
PYD
27
26
34
35
36

115

N

415 000 FEET

845 000 FEET

R. 2 E.

(Joins sheet 99)

405 000 FEET

R. 1 E.

(Joins sheet 82)

863 000 FEET

T. 1 S.

858 000 FEET

410 000 FEET

435 000 FEET

835 000 FEET

(Joins sheet 116)

BASELINE

ROAD

LIMIT

GILA

RIVER

SOIL

INDIAN

RESERVATION

SURVEY

BOUNDARY

PHOENIX

SOUTH MOUNTAIN

SOUTH MOUNTAINS

PARK

Mo

Es

AbA

Va

Tg

EbD

CeD

RS

CO

Gt

GgA

Ao

Ap

Ge

PeA

PeB

Gf

LcA

LcB

Cb

AfA

1 Mile

5000 Feet

Scale 1:20000

N

1 Mile 5000 Feet

0 0

Scale 1:20000

1 000 2000 3000 4000 5000

(Joins sheet 100)

R. 2 E. | R. 3 E.

455 000 FEET

845 000 FEET

T. 1 S.

(Joins sheet 115)

835 000 FEET

440 000 FEET

PHOENIX MOUNTAINS

SOUTH MOUNTAIN

SOUTH PARK

PHOENIX PROVING GROUNDS

Airstrip

BORROW PIT

RES BORROW PIT BDY

GRAVEL PIT

GILA RIVER INDIAN RESERVATION

SOIL SURVEY

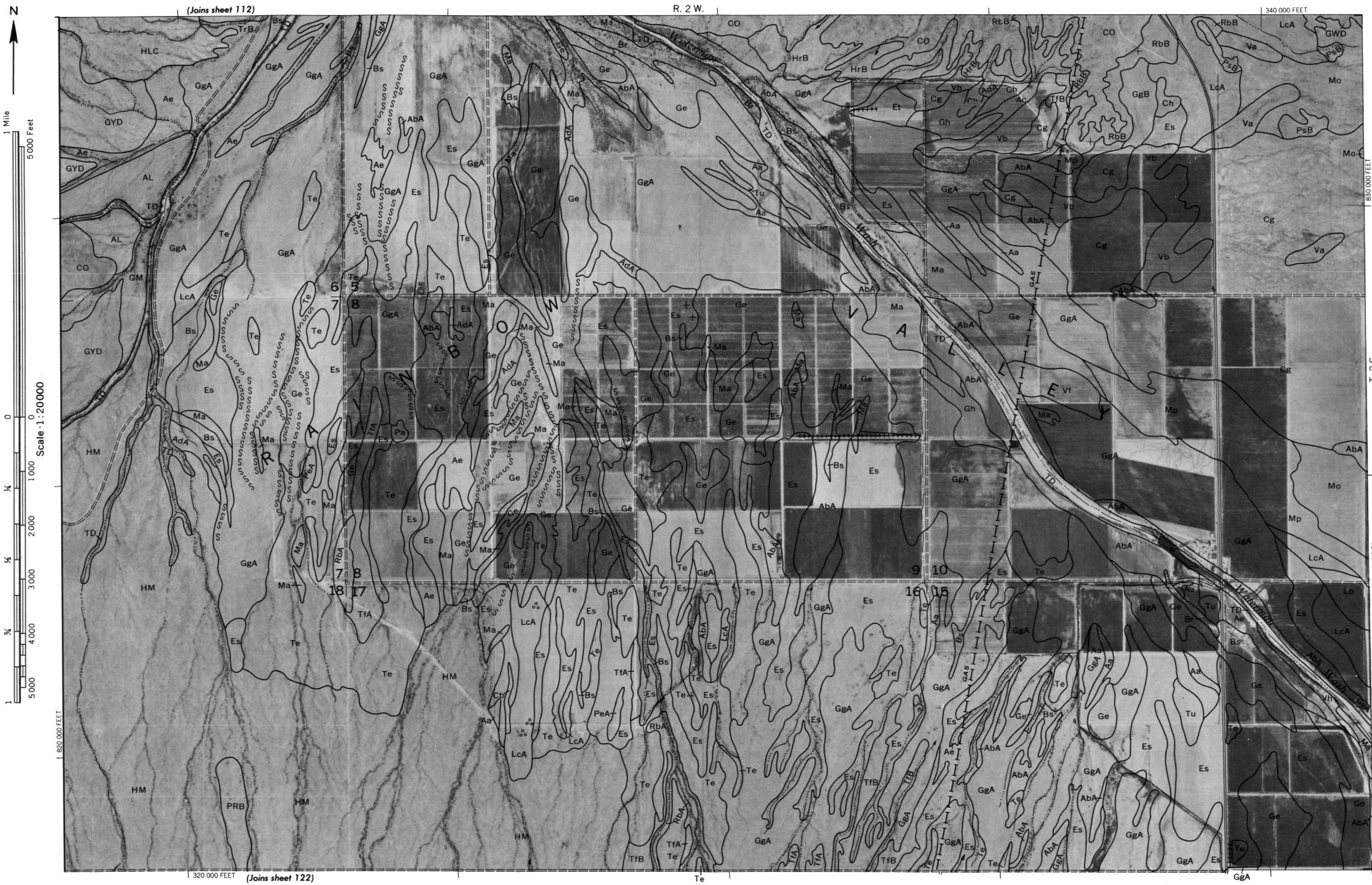
LIMIT OF BOUNDARY

23 24 26 25

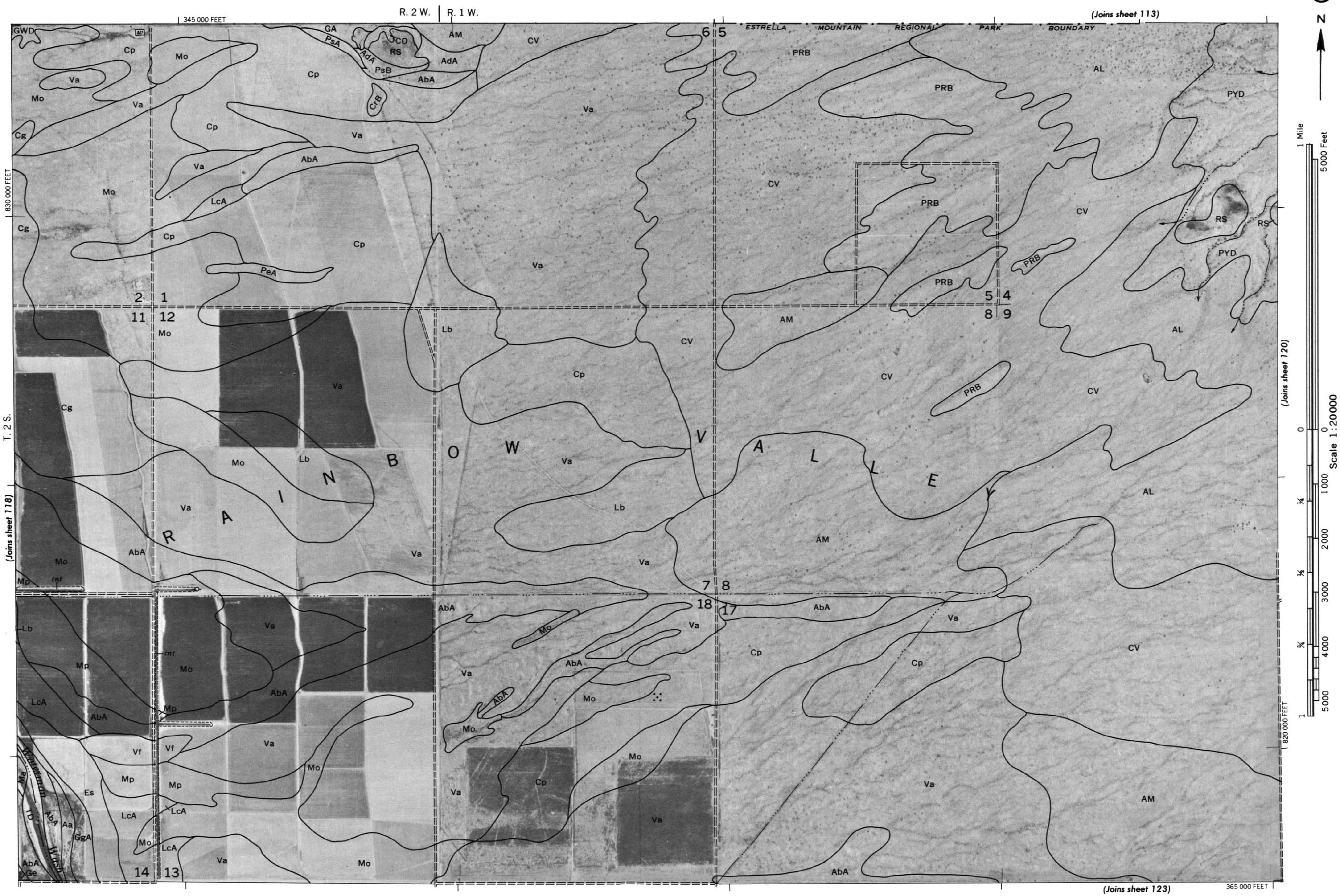
19 20 30 29

RS CO CeD EbD TB AbB AfA AfB EbD GWD PT Tc Es Cp Te


225 000 FEET
R. 5 W.
(Joins sheet 108)
830 000 FEET
T. 2 S.
6
3
N
1 Mile
5000 Feet
Scale 1:20000
0
1
5000
1000
2000
3000
4000
Gila River
VALLEY
ARLINGTON
ARLINGTON WILDLIFE AREA
Buckeye Hills
CANAL
AGB
ARLINGTON
820 000 FEET
(Joins sheet 121)
245 000 FEET


N
(Joins sheet 112)
R. 2 W.
340 000 FEET
830 000 FEET
T. 2 S.
(Joins sheet 119)
820 000 FEET
320 000 FEET
(Joins sheet 122)
Te
1 Mile
5 000 Feet
Scale 1:20000
Waterman Wash
RAINBOW VALLEY
GAS

MARICOPA COUNTY, ARIZONA, CENTRAL PART — SHEET NUMBER 119



N

1 Mile 5000 Feet

Scale 1:20000

0 0 1000 2000 3000 4000 5000

¼ ½ ¾ 1

(Joins sheet 114) R. 1 W. ESTRELLA MOUNTAIN REGIONAL PARK BOUNDARY 385 000 FEET

(Joins sheet 119)

820 000 FEET

370 000 FEET

830 000 FEET

(Joins sheet 124)

SIERRA ESTRELLA

RAINBOW VALLEY

3 | 2
10 | 11

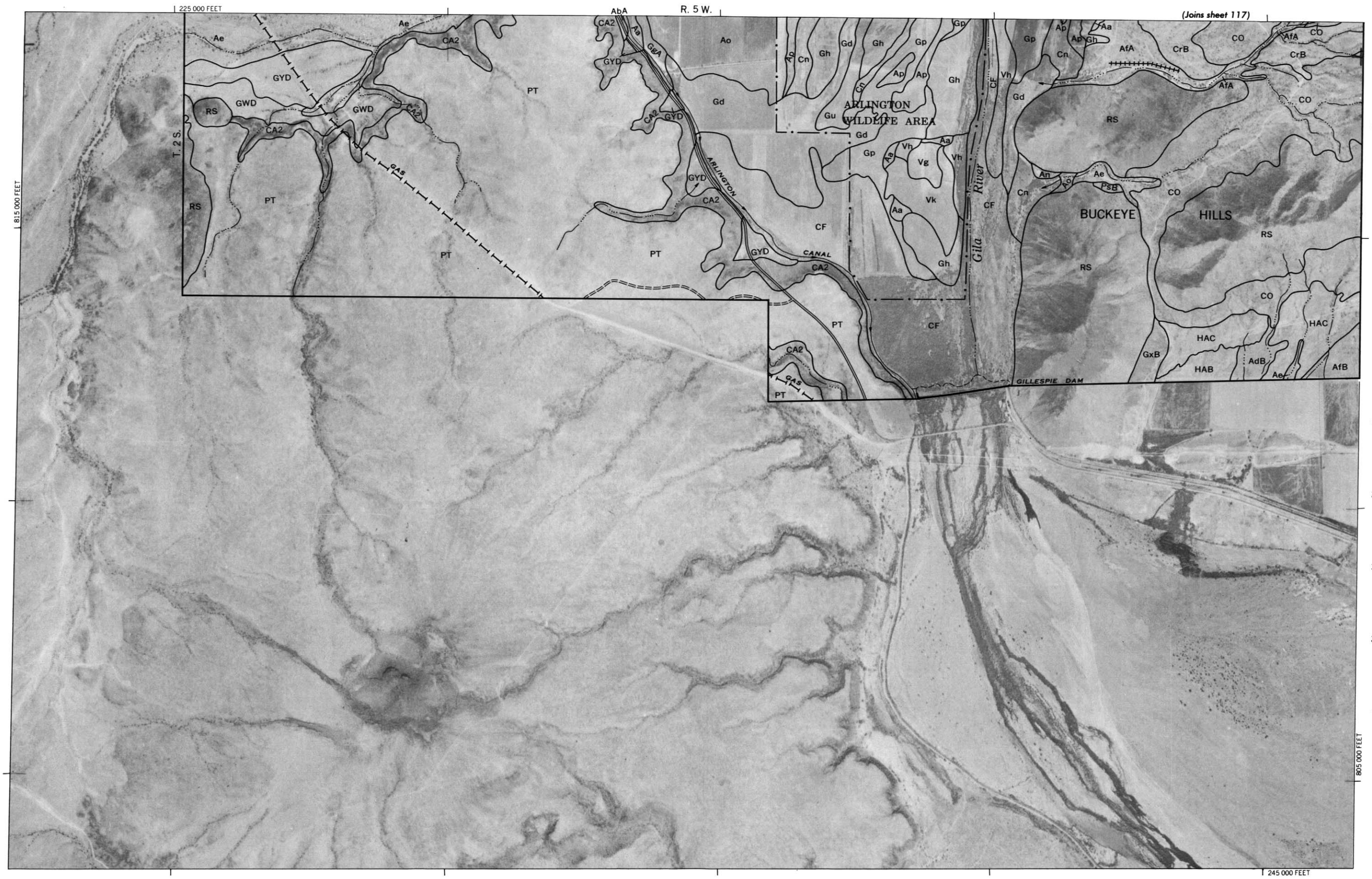
T. 2 S.

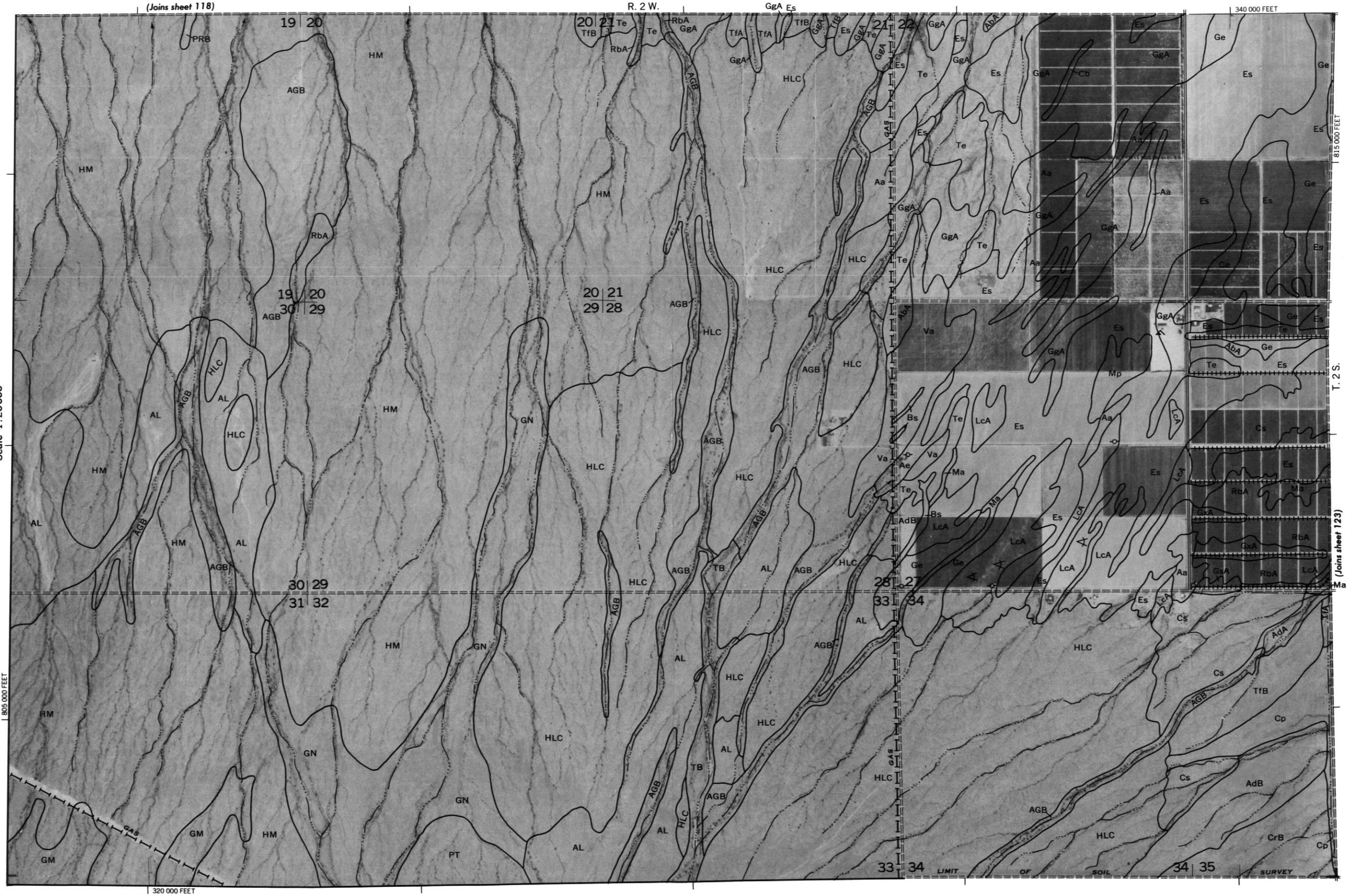
1

SOIL SURVEY BOUNDARY

RESERVATION OF INDIAN LIMIT RIVER GILA

RS PYD AL GYD TB CV AM


225 000 FEET
R. 5 W.
(Joins sheet 117)
815 000 FEET
T. 2 S.
ARLINGTON WILDLIFE AREA
ARLINGTON CANAL
Gila River
BUCKEYE HILLS
GILLESPIE DAM
805 000 FEET
245 000 FEET
N
1 Mile
5 000 Feet
Scale 1:20000


(Joins sheet 118)
R. 2 W.
340 000 FEET
815 000 FEET
805 000 FEET
320 000 FEET
T. 2 S.
(Joins sheet 123)
N
1 Mile
5000 Feet
Scale 1:20000
0
1 000
2000
3000
4000
5000
19 20
30 29
20 21
29 28
30 29
31 32
28 27
33 34
33 34
34 35
LIMIT OF SOIL SURVEY
GAS
PRB
HM
AGB
RbA
AL
HLC
GN
PT
GM
TfB
Te
GgA
Es
TfA
AbA
Aa
CD
Va
Ge
Ae
Ma
Bs
AdB
LcA
Mp
TB
GxA
Cs
AdA
Cp
CrB

123

N

R. 2 W. | R. 1 W.

345 000 FEET

815 000 FEET

T. 2 S.

(Joins sheet 119)

(Joins sheet 122)

(Joins sheet 124)

(Joins sheet 126)

365 000 FEET

805 000 FEET

RAINBOW VALLEY

Walerman Wash

LIMIT OF SOIL SURVEY

GM

Scale 1:20000

1 Mile 0 5000 Feet

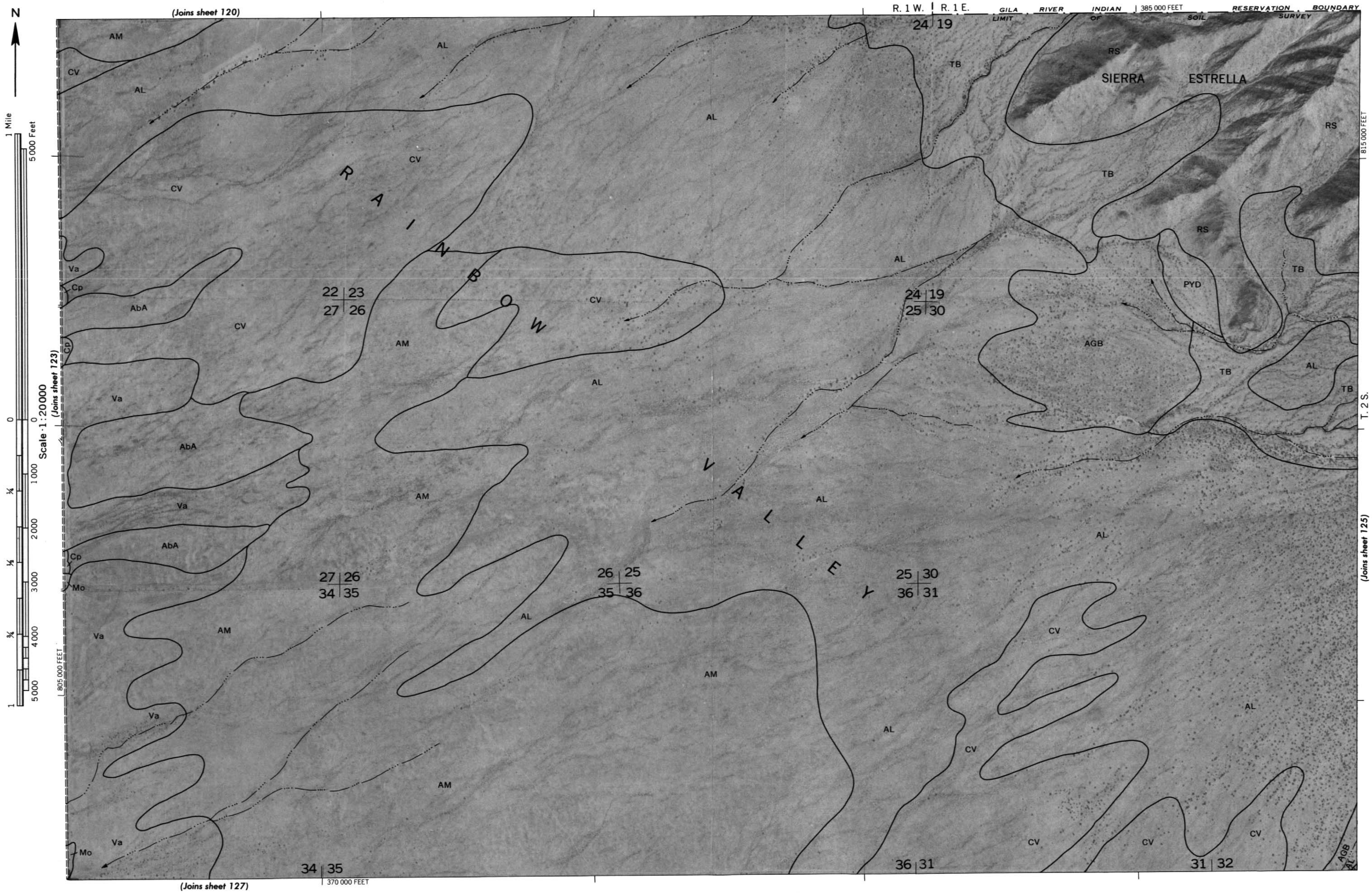
1 0 5000

¼ 4000

¼ 3000

¼ 2000

¼ 1000


N
(Joins sheet 120)
(Joins sheet 123)
(Joins sheet 125)
(Joins sheet 127)
R. 1 W.
R. 1 E.
GILA RIVER INDIAN RESERVATION BOUNDARY
LIMIT OF SOIL SURVEY
385 000 FEET
815 000 FEET
805 000 FEET
370 000 FEET
T. 2 S.
Scale 1:20000
1 Mile
5 000 Feet
0
1000
2000
3000
4000
5000
¼
½
¾
1
SIERRA
ESTRELLA
RAINBOW
VALLEY
24 19
22 23
27 26
24 19
25 30
27 26
34 35
26 25
35 36
25 30
36 31
34 35
36 31
31 32
AM
CV
AL
RS
TB
Va
Cp
AbA
PYD
AGB
Mo

MARICOPA COUNTY, ARIZONA, CENTRAL PART — SHEET NUMBER 125

125

390 000 FEET

GILA RIVER INDIAN RESERVATION BOUNDARY

SOIL SURVEY

R. 1 E.

815 000 FEET

T. 2 S.

(Joins sheet 124)

SIERRA ESTRELLA

Butterfly Mountain

PINAL COUNTY

RS TB AL AGB GYD PYD

(Joins sheet 128)

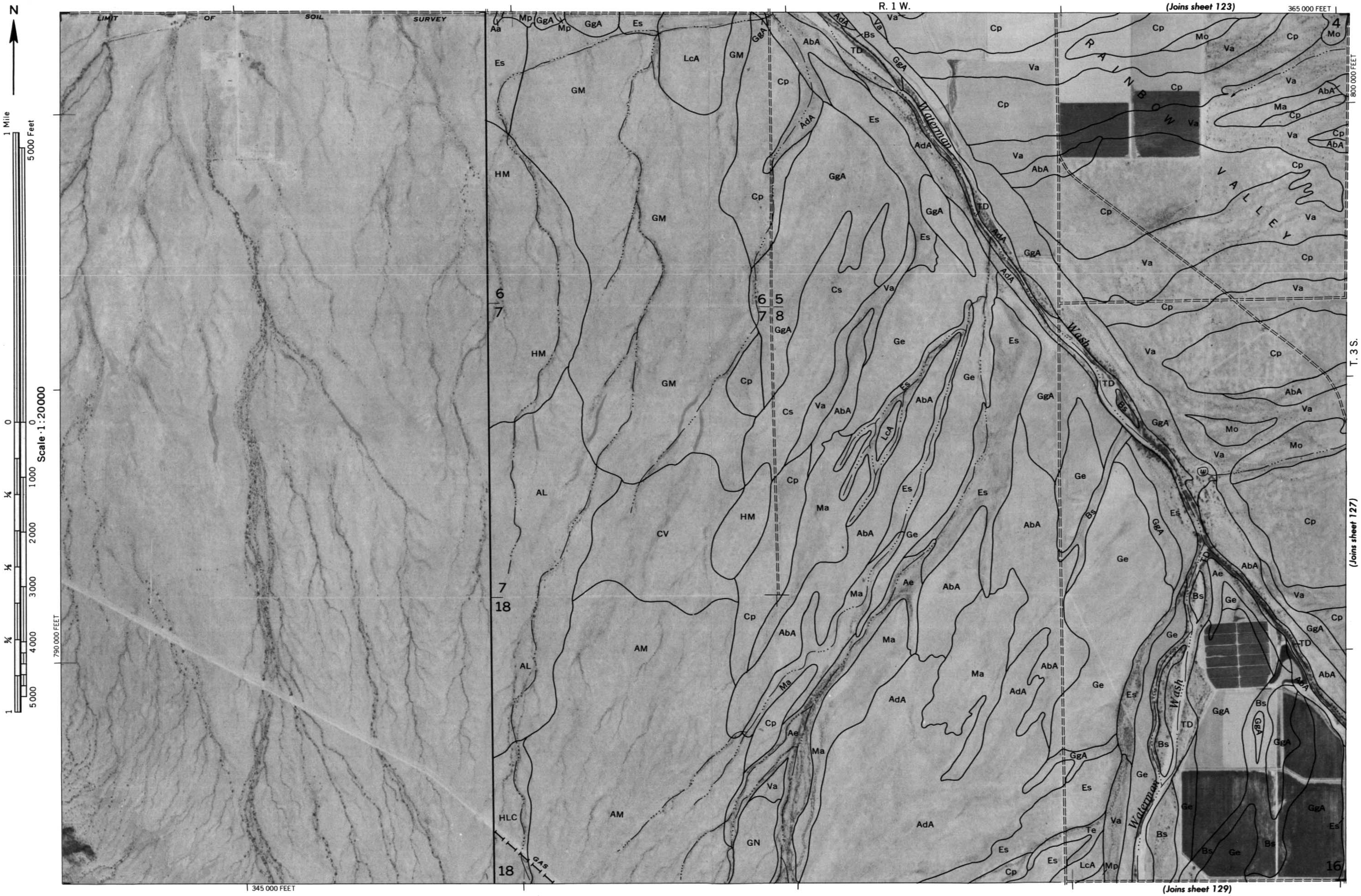
410 000 FEET

N

1 Mile

5000 Feet

Scale 1:20000


N
1 Mile
5000 Feet
Scale 1:20000
(Joins sheet 123)
R. 1 W.
365 000 FEET
800 000 FEET
T. 3 S.
(Joins sheet 127)
(Joins sheet 129)
345 000 FEET
790 000 FEET
LIMIT OF SOIL SURVEY
RAINBOW VALLEY
Waterman Wash
GAS

127

370 000 FEET

R. 1 W. | R. 1 E.

(Joins sheet 124)

800 000 FEET

T. 3 S.

(Joins sheet 126)

(Joins sheet 128)

790 000 FEET

(Joins sheet 130)

385 000 FEET

N

1 Mile 5000 Feet

Scale 1:20000

RAINBOW VALLEY

2 | 1

2 | 1
11 | 12

1 | 6
12 | 7

12 | 7
13 | 18

AM AL CV AGB Va Cp AbA AbB Mo Ae TD GgA LcA Es

N

R. 1 E.

410 000 FEET

(Joins sheet 125)

(Joins sheet 127)

790 000 FEET

390 000 FEET (Joins sheet 131)

800 000 FEET

T. 3 S.

1 Mile

5000 Feet

Scale 1:20000

0 0 1000 2000 3000 4000 5000

¼ ½ ¾ 1

AL AGB RS TB CV GYD GWD EPD PRB

SIERRA ESTRELLA

SOIL SURVEY

BOUNDARY

RESERVATION OF INDIAN

RIVER

GILA

LIMIT

PINAL COUNTY

345 000 FEET

785 000 FEET

R. 1 W.

T. 3 S.

(Joins sheet 126)

(Joins sheet 130)

775 000 FEET

360 000 FEET

N

Scale 1:20000

1 Mile 5000 Feet

0 1000 2000 3000 4000 5000

19 | HLC | AM | GN | AdA | Cp | LcA | Mp | Bs | Ae | Es | Ge | GgA | Va | TD | AbA | Ma

19 | 20
30 | 29

30 | 29
31 | 32

31 | 32

28 | 33

32 | 33

Waterman Wash

LIMIT OF SOIL SURVEY

N

1 Mile 5000 Feet

0 0

Scale 1:20000

¼ 1000 ½ 2000 ¾ 4000 1 5000

R. 1 W. | R. 1 E.

385 000 FEET

785 000 FEET

775 000 FEET

365 000 FEET

T. 3 S.

(Joins sheet 127)

(Joins sheet 129)

(Joins sheet 131)

RAINBOW VALLEY

23 | 24
26 | 25

24 | 19
25 | 30

19 | 20
30 | 29

27
34

26 | 25
35 | 36

30 | 29
31 | 32

35 | 36

LcA Es AbA GgA TD CP AM AL CV Va Cp Ae GM CrB PRB Cs Mp Ge GeA GAS Ma LIMIT Gr Ve MV

SOIL SURVEY

390 000 FEET

R. 1 E.

(Joins sheet 128)

785 000 FEET

T. 3 S.

(Joins sheet 130)

20 | 21

21 | 22
28 | 27

23 | 24
26 | 25

29 | 28
32 | 33

34 | 35
3 | 2

SIERRA ESTRELLA

AL
AM
AGB
CV
EPD
GWD
PRB
RS
TB
TPB
TSC

Es

LIMIT OF SOIL SURVEY

PINAL COUNTY

SOIL SURVEY BOUNDARY

INDIAN RESERVATION

GILA RIVER LIMIT

410 000 FEET

770 000 FEET

N

1 Mile

5000 Feet

Scale 1:20000